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Cover illustration
The Waratah, *Telopea speciosissima* (Sm.) R. Br., belongs to the family Proteaceae. The species is endemic in eastern New South Wales and is the official State floral emblem.
Illustration by David Mackay

TELOPEA

A journal of plant systematics

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The *Agathis brownii* case (Araucariaceae)

David J. Mabberley

Abstract

Mabberley, David J. (Nationaal Herbarium Nederland, University of Leiden, The Netherlands; and Royal Botanic Gardens Sydney, Mrs Macquaries Road, Sydney, NSW 2000, Australia) 2002. The Agathis brownii *case (Araucariaceae).* Telopea *9(4): 743–754.* Examination of Annual Reports of the Royal Botanic Gardens Sydney and early horticultural and travel literature, both published and in manuscript, shows that *Agathis brownii* (Lem.) L. Bailey was not based on New Caledonian material, as has been most recently argued, but is most likely a synonym of *A. macrophylla* (Lindl.) Masters, the name of a Melanesian species, though its being an older name for *A. robusta* (C. Moore ex F. Muell.) F. Bailey cannot be entirely ruled out. During the investigation of the case it became necessary to lecto- or neo-typify *Agathis australis, A. lanceolata, A. robusta* and *Dammara ovata* C. Moore ex Seem. (= *A. lanceolata* Warb.) and to correct a number of citations of both authors and place of publication of names in *Agathis, Araucaria* and *Dammara*.

Introduction

In sorting out the eponymy of Robert Brown (1773–1858) for a future publication, consideration has had to be given to *Dammara brownii* [Hort. Angl. ex] Lem., i.e. *Agathis brownii* (Lem.) L. Bailey (Araucariaceae), named in Brown's honour according to Chittenden (1951: 64, 318). However, Brown was not mentioned by the original author, Lemaire, who based the name on a young pot-plant growing in a greenhouse at Van Geert's nursery in Ghent (Gand), Belgium, in 1855. Accompanying an illustration of the growing plant, Lemaire wrote enthusiastically about the new acquisition which Van Geert had bought in England.

In his *Flora vitiensis* (1868: 264) Seemann placed *D. brownii* illegitimately in the synonymy of the younger name, *Dammara robusta* C. Moore ex F. Muell. (1860). In 1900, Warburg (see Appendix) referred *D. brownii* to the synonymy of *Agathis robusta*, a new combination he was proposing based on *D. robusta*; his new combination was therefore illegitimate but, fortunately, the binomial had already been legitimately published by F.M. Bailey in 1883 (see Appendix). However, from the 1930s to 1970s the Queensland kauri, *A. robusta* (F. Muell.) F.M. Bailey, in cultivation in America and Europe, was known as *A. brownii*, being listed under that name in the standard horticultural works of the period (see below).

But *D. brownii* has been placed in the synonymy of many other species, too (see Appendix for precise references): Carrière, and Decaisne & Naudin ('le dammara de Brown', 'de l'île septentrionale de la Nouvelle-zélande') referred it to a New Zealand species (the only one there being *A. australis* (see below); many plants cultivated in Europe as *A. australis* are indeed *A. robusta*, according to Royal Horticultural Society Dictionary 1: 82, 1992). Both Gordon and Henkel & Hochstetter had *D. brownii*, as well as *D. bidwillii* (see Appendix), in the synonymy of *D. obtusa*, now a synonym of *A. macrophylla* (Lindl.) Masters, a tree from Melanesia, to which *D. robusta* was also referred by Henkel & Hochstetter. In the most recent revision of the genus, Whitmore (1980) has it as a New Caledonian species (see below)!

Indeed, the name has been treated as a *nomen dubium* according to Whitmore (1980), following Hyland (1978), perhaps in turn following Barrett (see Appendix), who revived the name *A. robusta*, based on *Dammara robusta* F. Muell. (1860), a name younger than *D. brownii*.

What, then, is *D. brownii*? Is it really *A. robusta* and therefore a name to be proposed for rejection in maintaining the name *A. robusta* for the Queensland kauri? There is no known herbarium voucher, nor any description not derived from the original, nor any other illustration published. The Queensland kauri is planted in Central Sydney and so, in connexion with a proposed Greening Australia/Royal Botanic Gardens Sydney project on 'Sydney Trees', it has now become doubly necessary to sort this out.

As a piece of detection, in accumulating circumstantial evidence to ascertain its identity, largely by elimination, it has been necessary to examine carefully the early records of introduction to Europe of the species of *Agathis*, critical in which is the role of the first two Directors of the Royal Botanic Gardens Sydney, John Carne Bidwill and Charles Moore. Starting with the Queensland kauri, to which *D. brownii* has most often been referred in this century, the following argument will show that the plant is probably not Australian at all, in which case its name is not a threat to *A. robusta*; moreover it does not even commemorate Robert Brown. In investigating the case, it has become necessary to propose a number of new typifications (see Appendix).

Australia: *Dammara robusta*

Devon-born John Carne Bidwill (1815–1853), first Director of the [Royal] Botanic Gardens Sydney (Mabberley 1996, 2001) is commemorated in the Latin name of the bunya-bunya, *Araucaria bidwillii* Hook. (Araucariaceae), a tree he introduced to cultivation in Europe when he returned to England with live plants of it in 1843. Over the following years, he sent further live bunya-bunya trees to England in cases provided by his patron, William Macarthur at Camden Park, NSW. By 1850, Macarthur could include in his 'Catalogue of plants cultivated at Camden Park in 1850' another conifer, *Dammara* sp., from Wide Bay [Queensland], where Bidwill was by then Commissioner of Crown Lands, a post he was offered in recompense for the government bungling which had led to his being deprived of the Directorship of the Sydney Gardens and being replaced by the second Director, Charles Moore (1820–1905).

On 2 January 1849, in a letter reprinted in *Hooker's Journal of Botany* 1: 284–6 (1849) under 'Another coniferous tree detected in Australia', Bidwill had written from Wide Bay about his triumph in finding the conifer that New Year's Day. In 1842 an Aborigine at Moreton Bay had told him about the tree but no-one else could attest to it until Bidwill found it on the site of the future Maryborough. To get the single cone the plant bore, Bidwill had to have the tree felled. By the end of March he was building his house from kauri timber. He deliberately did not send seeds directly to the Sydney Botanic Gardens or to nurserymen such as T.W. Shepherd in Sydney (Mabberley 1996), and so it seems indisputable that it was Macarthur who not only germinated Bidwill's seeds but also distributed the first-raised young plants in the colony. According to a photocopy (Royal Botanic Gardens Sydney) of his 'Catalogue of plants cultivated at Camden Park in 1850', annotated in his own hand, plants were available at 10 shillings each.

A tree planted in 1853 in what was to become a collection of *Agathis* spp. in the 'Upper Garden' (now part of the 'Middle' Garden) at the Royal Botanic Gardens Sydney, shown as the *Agathis* collection at the edge of the Palm Grove in the 1871 plan of the Gardens where some trees still survive (Bed 28a), is therefore most likely to have been one of the progeny: it was '40 feet' high in 1861, when Seemann studied the living collection (*Flora Vitiensis*: 264 [1868]), and had reached '53 feet' by 1871 (Ann. Rep.

1870–1: 2). Today it is the tallest tree in the Gardens (32.8 m in 1996). Six other seedlings were sent to England from Camden on Christmas Eve 1854 (Mabberley 1996).

According to the archival records in the Royal Botanic Gardens Sydney ('Plants sent away 1852–1870' f. [4]), living material of the 'Dammara sp., Wide Bay' was sent to Henderson's Nursery, Pineapple Place, in London on the *St George* on 1 April 1852 (see also Ann. Rep. 1853: 3, 4, where it is recorded that plants were also sent to Sir Joseph Paxton at Chatsworth for the Duke of Devonshire). And again, on 27 April 1853 ('Plants sent away 1852–1870' f. [8]; Ann. Rep. 1854: 3) one 'Dammara nova sp. New Holland' was sent by Moore to his brother David Moore (1807–1879) at the Royal Botanic Gardens Dublin, at Glasnevin. For 8 Sept. 1853 the Glasnevin records show 'from Mr. Moore Sydney. Wardian case of valuable plants' but it is not known whether the tree survived the voyage.

It was only in 1854, though, that Charles Moore could report he had been to Wide Bay, not only to examine the remains of the late John Bidwill's Botanic Garden at Tinana, Maryborough, but also to collect seeds and plants for the Sydney Gardens as well as wood samples for the Paris Exposition of 1855 (Ann. Rep. 1854: 2). It would appear that this collecting journey was the origin of the next Botanic Gardens stock of the new tree, as Moore was able to send out young plants in bulk in 1854–5 (Ann. Rep. 1855: 4–6), material being sent out as 'Dammara new sp., New Holland'. It was sent to England (Veitch's nursery in Chelsea, the Royal Botanic Society's garden in Regent's Park, London and Henderson's (six plants), to Hooker at Kew), as well as to Baptist's Nurseries, Surry Hills, Sydney, and to botanic gardens in Java and Cape Town.

'Dammara sp. Le 'Kaurie Tree' de Wide Bay' was no. 75 of the Moreton Bay and Wide Bay woods sent by Macarthur and Moore to the Paris Exposition of 1855; there is voucher material (fertile) in the Paris herbarium. In the Australian Horticultural and Agricultural Society's spring show (the *Sydney Morning Herald*'s verdict [2 Oct., p. 5] 'in fact to do justice to it and to the judges, we must pronounce it the worst we remember to have seen') held in Sydney 1–2 October 1857, there was 'approbation to the Messrs. Shepherd's superb collection of plants for landscape embellishment'. The exhibit, which won a gold medal, comprised '35 varieties' including *Araucaria bidwillii* Hook. and the 'Wide Bay Kowrie', i.e. Queensland kauri (Mabberley 2001), then known in the trade as *Dammara bidwillii*.

By 1856, though, Moore was sending out saplings of the Wide Bay species as 'Dammara robusta MSS' (Ann. Rep. 1856: 3–4) to Henderson's and others in England. The next year (Ann. Rep. 1857: 5–6) Moore supplied 36 to Baptist's in Sydney, 36 to Guilfoyle also in Sydney, as well as 15 to Henderson's in London, three for 'King George Sound', two for Sri Lanka (Peradeniya) and one for Singapore, for example. That year it was listed as *D. robusta* in the catalogue of the plants growing in the Sydney Botanic Gardens and an illustration of a young plant growing there was published in *The Month*, a Sydney periodical, by its editor, Francis ('Frank') Fowler (1833–1863), again with Moore's new name, *D. robusta*. The tree illustrated is that which is now the tallest of all the trees in the Gardens: it was then about five years old so was probably the one planted in 1853, most probably from Macarthur's initial stock raised at Camden Park from Bidwill's seeds.

In 1858, Moore sent seeds and cones to James Clary at the Wide Bay settlement and more plants to Henderson's, to Calcutta, to Sri Lanka, Western Australia and to an Adelaide nurseryman (Ann. Rep. 1858: 7). Only in 1860, though, was a formal description of *D. robusta* published by Ferdinand von Mueller, based on 'scanty material' made available to him in Melbourne by T.W. Shepherd's Darling Nursery in Sydney (see Appendix).

The evidence thus shows that the major European introductions of *Agathis robusta* (in 1854–56) were just too late for them to be the *D. brownii* already in cultivation in Europe by 1855. It is possible that those raised from Bidwill's seeds by Macarthur reached Henderson's by then, but I can find no mention in the contemporary horticultural literature or nurserymen's catalogues of what would have been an outstanding new introduction. The first stock raised from seeds collected by Moore in 1854 could possibly have reached Europe by then, too, and perhaps Veitch made it available to Van Geert, but there is no evidence so far for its being offered for sale in England at that time.

So, on the circumstantial evidence available, it would appear that Australia cannot be considered as the certain origin of the plant named *D. brownii* by Lemaire. But, as Hyland (1978) points out, confusion may have initially arisen in Australia, with Walter Hill's use of that name for the Queensland kauri in his exhibit for the International Exhibition held in London in 1862 (see below). In addition, 'D. Brownii Hortulanorum' is found in Mueller's hand on the MEL 1582082 (MEL) sheet of *A. robusta*. Moreover, the typification of *D. robusta* has not been clear: even in recent works the type is incorrectly attributed to Moore, and so a lectotype is chosen in the Appendix.

According to Whitmore (1980), *Dammara brownii* was indeed not Australian but came from New Caledonia.

New Caledonia: *Dammara moorei*

In 1850, Moore had been invited to sail on HMS *Havannah* (Capt. John Elphinstone Erskine, 1805–1887) to islands in the western Pacific (Bennett 1860: 351). Near Hienghène on the east coast of New Caledonia, he collected material of an endemic species, the 'kaori blanc', the only one from the island to be known in Europe before 1855. In his journal for October 1850 (a MS copy preserved in the Royal Botanic Gardens Sydney) he wrote (ff. 61–2), 'At this place I either observed or collected the following *Dammara Nova Species* a most beautiful tree … '. He [f. 66] tried to get natives to bring young plants and cones but to no avail despite 'a grand reward'. It was described, as *D. moorei*, from his herbarium material, by Lindley, who had been instrumental in the appointment of Moore and thereby the ousting of Bidwill (Mabberley 1996).

In 1851 (Ann. Rep. 1852: 3, 7) Moore could send live material of 'Dammara Moorii' from New Caledonia to Henderson's in London and to the 'Government Botanic Gardens, Batavia'. There is no evidence that this species was ever announced for sale though, and, in any case, in its young stages it has lanceolate leaves unlike Lemaire's *D. brownii*, so New Caledonia would appear not to be the source of *D. brownii* after all. Indeed *D. moorei* was still being exhibited as a novel young plant by William Bull as late as 1864 (Anon. in Gard. Chron. 1864: 654). On the other hand, a specimen had been planted in Sydney next to the plant of *D. robusta* in 1853 (Ann. Rep. 1870–1: 2) and was therefore in the same bed as the tree illustrated as *D. robusta* in the plate published in *The Month*. That, too, still survives in bed 28a and is labelled *Agathis moorei*.

Moreover, *Dammara brownii*, when first described, was actually said to have originally come, not from 'Nouvelle-Calédonie' but from 'N[ouv]elle Ecosse' (i.e. 'New Scotland'), and although this was referred to New Caledonia by de Laubenfels reported in Hyland (1978), this name in French actually refers to Nova Scotia, a name used today for part of Canada. Some early settlements near present-day Waipu, in the North Island in New Zealand were called the Nova Scotian settlements (Robinson [1952: 139]; Reed [1956: 238]) because the Gaelic-speaking settlers had come from Nova Scotia in Canada: Waipu is in *Agathis* country.

New Zealand: *Dammara australis*

The name *Dammara bidwillii* used by Shepherd for *A. robusta* in the 1857 spring show has been applied to the New Zealand species *A. australis* (see Appendix). Moreover, there was in New Zealand, at Christchurch, a second botanical Robert Brown (1824–1906), who could conceivably have been the eponymous 'Brown' (and is indeed confused with the first Robert Brown in the supplement to Stafleu & Cowan's *Taxonomic Literature*!).

But these are false leads, because *Agathis australis* is the only native New Zealand species and was in cultivation in Europe at the latest by 1824 (1821 according to Lindley; 1823 according to RHS Dictionary ed. 1: 64, 1951) and so was well known in cultivation long before 1855. In any case, in youth it differs markedly from *A. robusta* in its smaller, narrower leaves.

It should be noted that the name *Agathis australis* has been assumed to be based on *Dammara australis* D. Don., but the first publication of the name in *Agathis* has until rather recently been overlooked. Although noted by Moore and Edgar in 1976 (see Appendix) it has still to make its way into *Index Kewensis* and has not yet been typified, which is remedied in the Appendix below.

New Zealand would appear to be ruled out too — another blind alley in the case — so perhaps Nova Scotia is the result of a confusion, probably arising in Belgium, because, as The Hebrides are part of Scotland, The New Hebrides (i.e. Vanuatu) could, perhaps, have been referred to as a 'New Scotland'?

Vanuatu: *'Dammara ovata'*

Moore visited Aneityum in Vanuatu on the voyage of the *Havannah*. In his journal (f. 19 of the MS copy held at Royal Botanic Gardens Sydney), he noted that in August 1850, 'only two Conifers were observed ... one a large and noble sp. of *Dammara* three times the size in its leaves and cones to that of New Zealand [*A. australis*] but scarcely as large a tree, two hundred and eighty [growth] rings were counted in a large block lying at Captain Padden [Paddon]'s establishment — this plant is not uncommon on the South-West side of the island extending its range from the sea to the tops of the mountains'. A specimen of it that he collected there he named *Dammara ovata* on a manuscript label sent to Lindley in England. Lindley made the specimen bearing Moore's unpublished *D. ovata* and 'New Hebrides and Fiji Islands' the type of his new species, *D. obtusa*.

Lindley referred a second specimen, collected by Moore on the *Havannah* voyage from Vanikoro in the Solomon Islands (Santa Cruz Island) and intended by Moore to be called *D. peyrousei*, to another new species, *D. macrophylla*. Moore wrote of Vanikoro in his journal (f. 50) for 13 September 1850, 'We had not proceeded far before it commenced raining a perfect deluge. We determined however to persevere in our excursion and was [sic] rewarded by the discovery of a noble sp. of *Dammara* and other valuable plants ... [f. 53] The cones and leaves are at least 10 times the size of *D. australis* and twice that of the sp. found at Anateum [sic]. As a kauri is found on Erromango it may possibly be an intermediate sp. or var. between this and that'. Indeed Moore's (and Lindley's) two species, together with *D. vitiensis* Seem., described later from Fiji, are now considered conspecific and referred to *Agathis macrophylla* (Lindl.) Masters (Whitmore 1980).

However, the name *Dammara ovata* has become much confused (see de Laubenfels 1972: 134, 141 for partial explanation) and was used in print later for two very different species, both from New Caledonia. In the 1857 catalogue of plants growing in the Sydney Gardens, Moore used the name for a second species collected in New Caledonia

(his original *D. ovata* from Aneityum was correctly listed there as *D. obtusa*, i.e. *A. macrophylla*). A cone of his second *D. ovata* (= *Agathis lanceolata* Warb.) was illustrated that year, on the same plate as *D. robusta*, in *The Month*. This was the second known New Caledonian endemic species and, although in its juvenile stages it has leaves like those of *D. brownii*, it was apparently not in cultivation in Europe when the latter was described, though in NSW there is a specimen ('1850') mounted with one of *A. moorei*.

Before 1860 Moore's friend, Captain James Paddon, then living in New Caledonia (Bennett 1860: 353), had brought indigenous people from both Vanuatu and New Caledonia to see the Sydney Gardens. Between them, these people recognised *A. macrophylla* (*D. obtusa*) and *A. moorei* growing with *A. robusta* in what is now Bed 28a, though an inhabitant of the Isle of Pines recognised none and explained that there was another tall species in the south of New Caledonia, but unrepresented in the Gardens collection then. This was probably the 'Koghis kauri' and, subsequently, it was introduced to Sydney from the Nouméa area. Moore sent herbarium material of this, his second '*D. ovata*', collected in New Caledonia, to Lindley. But Lindley did not publish this *D. ovata* either, under any name, and this species is now correctly *A. lanceolata* Warb. (see Appendix).

It should be noted that the shrubby species (unfortunately, in view of the above) now called *A. ovata*, based on Vieillard's misinterpretation of Moore's name, is a third New Caledonian endemic, the scrub kauri, and was Moore's *Dammara hypolenca* introduced to France in 1862 (Carrière, Traité Conif. ed. 2: 624, 1867) — see Appendix below.

In describing *Dammara obtusa*, i.e. *Agathis macrophylla*, Lindley had not only a cone and specimens but also a living plant. In 1851 (Ann. Rep. 1852: 3, 4, 7, 10), Moore received live Aneityum material of *D. obtusa* from Paddon, and sent out live material to Henderson's, to his brother at Glasnevin, to the Duke of Bedford at Woburn Abbey, to the Royal Botanic Society's garden in Regent's Park, London, to the Horticultural Society's garden at Chiswick, to Kew and to the 'Government Botanic Gardens, Batavia'. In that year Shepherd's could offer it as Moore's introduction, *Dammara* 'sp. from Anatum'. In 1852 (Ann. Rep. 1853: 3, 4, 5), Moore sent more to the Jardin des Plantes in Paris, to Thomas Moore (1821–1887, no relation) at the Chelsea Physic Garden, to Louis Napoleon, 'the Prince President of France', to Paxton for the Duke of Devonshire, and to the Duke of Richmond. Next year, not only Henderson's but also Rollisson's ('Rollinson') of Tooting and the botanic gardens in Hamburg were supplied with plants (Ann. Rep. 1854: 3, 6).

Unlike all the other 'novel' species considered in this paper so far, live material of '*D. obtusa*' was available to Lindley as early as 1851 and it was early sent under that name to a number of firms in London. It seems then that this could well have been the original *D. brownii*.

But how was Robert Brown implicated? He had neither been to Vanuatu, nor written about this plant, nor was he referred to by Lemaire. Why does '*D. brownii*' not even feature in the British horticultural literature of the period, when it was so lauded by Lemaire? Where did Van Geert, whose agent in London was R. Silberrad of 5 Harp Lane, Tower Street (Gard. Chron. 13 Oct 1855: 673), get his plant?

The case solved?

As early as 1867 Carrière (see Appendix) had indeed considered *Dammara brownii* conspecific with *D. macrophylla*, but reduced the latter name, illegitimately, to *D. brownii*, noting it had been introduced to France in 1855 — though he wrote that the plant was from New Zealand, where the sole species is *Agathis australis* (see above). He roundly criticised Gordon's synonymizing *D. brownii* with *D. bidwillii*, though Gordon

(see Appendix) had amalgamated *D. brownii* and *D. obtusa* (i.e. now *A. macrophylla*) as early as 1858 and before Seemann in 1868 had allied it with *D. robusta*, perhaps following Hill and von Mueller (see above).

In 1855, '*Dammara obtusa*' was one of the 'New and Rare Plants' (Gard. Chron. 14 July 1855: 467) offered at 31/6 by the firm of J. & C. Lee in Hammersmith ('The Trade Supplied'), so *Agathis macrophylla* was certainly readily available in England in 1855. And it could well be that the complete answer lies in one of Carrière's synonyms, '*D. brownii obtusa* Hort.', because one of the London firms at this time was J. and H. Brown, Albion Nursery, Stoke Newington, whose advertisements also appeared regularly in the *Gardeners' Chronicle* (e.g. 1855: 754), though no published advertisement with *D. obtusa* has yet been found perhaps because the firm supplied directly to 'the trade' and therefore possibly directly to van Geert.

With all the circumstantial evidence, particularly the fact that Lindley had described *D. obtusa* from a live plant in England, but also that in the original description *D. brownii* was described as a very vigorous greenhouse subject with large leaves (like *A. macrophylla*), supporting which Whitmore (1980) notes that *A. macrophylla* is 'Occasionally cultivated in temperate glasshouses, where it has produced cones', the most parsimonious solution in this detective story — whatever the precise explanation — is that the plant was labelled 'Dammara Brown's obtusa', or similar, and became confused, '*D. brownii*' therefore inadvertently commemorating the nurseryman and not the great botanist.

On that hypothesis then, *D. brownii* is from neither Australia nor New Zealand nor New Caledonia, as has been recently supposed, and the relevant synonymy is:

Agathis macrophylla (Lindl.) Masters, J. Roy. Hort. Soc. 14: 197 (1892); Dümmer, J. Roy. Hort. Soc. 39 : 83 (1913); Whitmore, Pl. Syst. Evol. 135: 60 (1980).

Dammara macrophylla Lindl., J. Hort. Soc. 6: 271 (1851).

Dammara brownii [Hort. Angl. ex] Lem. [var.] *macrophylla* (Lindl.) Carr., Traité Conif., ed. 2: 622 (1867), *nom. illeg.*

Type: Solomon Is. (Santa Cruz Is.), Vanikoro Is. ['Vanikolla' ('Peyrouse's Is.'), 13 Sept. 1850], *C. Moore 'N° 9'* (CGE, holo [P, photo! See also Dümmer, J. Roy. Hort. Soc. 39: 83 (1913)], K iso).

[*Dammara* 'sp. from Anatum', Shepherd, Cat. Darling Nursery 15 (1851)]

Dammara obtusa Lindl., J. Hort. Soc. 6: 270 (1851) & in Paxt., Fl. Gard. 2: 146 + t. (1851–2); Lem., Jard. Fl. 2, Misc.: 111 + t. (1852); Gordon, Pinetum 79 (1858) & Suppl. 28 (1862), excl. syn. *D. bidwillii* & *D. robusta*; Henkel & Hochst., Syn. Nadelh. 216 (1865), excl. syn. *D. bidwillii*; Dümmer, l.c. (1913).

Agathis obtusa (Lindl.) Masters, J. Roy. Hort. Soc. 14: 197 (1892).†

Agathis macrophylla (Lindl.) Masters var. *obtusa* (Lindl.) Silba, Phytol. 68: 23 (1990).

Type: [Vanuatu, Aneityum, Aug. 1850], ('New Hebrides and Fiji Islands'; 'D. ovata Moore'), *C. Moore 'No. 7'* (holo-, CGE (photo P), iso-, K).

[*Dammara peyrousei* [C. Moore ex] Hook., J. Bot. Kew Misc. 4: 115 ('*peyrousii*'), t. 4 ('*perousii*') (1852), nom. in syn.]

† Also published by Mottet, Dict. Prat. Hort. 1: 77 (1892) [as is **A. orientalis* (D. Don) Mottet, l.c. — nom. superfl. pro **A. dammara* (Lamb.) Poir. in Lam., Tabl. Enc. 6: 711, t. 997 (1823), syn. **Abies dammara* (Lamb.) Dum. Cours., Bot. Cult. ed. 2, 6: 474 (1811)].

*Additions to *Index Kewensis* and other lists

?Dammara brownii [Hort. Angl. ex] Lem., Ill. Hort. 2, Misc.: 60 cum tab. (1855); Hérincq, Hort. Franç. 192 (1855) ; Courtin, Fam. Conif. 99 (1858); Carr., Traité Conif. ed. 2: 621 (1867); Dene & Naudin, Man. Amat. Jard. 3: 321 (1868); Whitmore, Pl. Syst. Evol. 135: 66 (1980).

?Agathis brownii (Lem.) L. Bailey, Cult. Conif. N. Am. 18, 151 (1933), excl. syn. *A. robusta* & descr.; Chitt., Dict. Gard. 1: 64 (1951), excl. syn. *A. robusta* & descr.

Type: Bought in England and cultivated at Van Geert's Nursery, Ghent, Belgium (?not preserved, in which case Stroobant's lithograph published by Lemaire, l.c., should serve as 'iconotype').

[*Dammara brownii obtusa* Hort. ex Carr., l.c., nom. in syn.]

Native in Solomon Is., Vanuatu, Fiji (Note that another synonym, based on Fijian material, is:

**Agathis vitiensis* (Seem.) Benth. & Hook.f. ex Drake, Ill. Fl. Ins. Pacif.: 353 (1892); Farjon, Bibliog. Conifers: 20 (1998, q.v. for further synonymy).

Conclusion

It can be concluded, using the above reasoning, that *Dammara brownii* was Moore's first *D. ovata*, i.e. *A. macrophylla* (var. *obtusa*) discovered by him in Vanuatu in August 1850, sent to Lindley, and also planted in the Sydney Gardens in the kauri collection with the young *D. robusta* raised by Macarthur from Bidwill's seeds. That tree was later joined by the second '*D. ovata*' [labeled '*A. ovata*' today!], i.e. *A. lanceolata* from New Caledonia. Lindley changed the second '*D. ovata*' to *D. obtusa* and through him it reached the London trade and thence, with a garbled name, Belgium, Van Geert and Lemaire, who (inadvertently?) described it as new all over again.

If this is so, *Dammara brownii* is therefore neither an Australian plant nor one commemorating Robert Brown. This conclusion was reached long ago — but has apparently been completely overlooked: in Guilfoyle & Son's 1862 *Catalogue of plants*, p. 14 (copy at MEL) and, again, in their *Catalogue of ornamental trees and shrubs … 1866* p. 16, describing the conifers grown at their Double Bay nursery, Sydney, *D. brownii* is firmly in the synonymy of *D. obtusa*, i.e. *Agathis macrophylla*. Carrière in France (and effectively Gordon before him — see above and in Appendix) also recognized the identity of *D. brownii* with what is now *A. macrophylla*. Horticulturists nowhere took up the (apparently bogus) name *D. brownii*, though taxonomists have allotted this binomial to the synonymy of a whole array of different species. This is, then, yet another example where horticultural work on Australasian plants, including that published in Continental Europe, has been neglected by botanists (cf. Mabberley 1991, 1999).

The possibility, extremely unlikely as it is, that *D. brownii* was an otherwise unrecorded name used by nurserymen in England in 1855 for *D. robusta*, and that 'Ecosse' was a slip for '[Nouvelles] Galles [du Sud]' (i.e. [New South] Wales) or a corruption of 'New Holland' — as very far-fetched as this seems — cannot be entirely ruled out, however. In consequence, any detractors from the hypothesis presented above would be obliged, in the interests of nomenclatural stability, to proscribe the name *Agathis brownii* lest it ever be resurrected for *A. robusta*.

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Appendix: Synonymy of other taxa discussed in the case

[Names marked with an asterisk are not in *Index Kewensis* or other lists]

***Agathis australis** [Hort. ex] Lindl. in Loud., Encycl. Pl.: 802 (1829); Moore & Edgar, Fl. New Zealand 2 : 329 (1976).

Type (**neotype designated here**): as lectotype of *D. australis*, below.

Dammara australis D. Don in Lamb., Pinus 2 : 14 & t. 6 (1824). Type : New Zealand [Bay of Islands, May–June 1820 — according to 'Bay of Islands shipping arrivals and departures 1803–1840', teste Mark Large], *J. Downie s.n.* in Herb. Lambert (lost?), the basis of the Lambert plate by Sowerby (lecto, effectively selected by Whitmore [1980: 54]).

[*Dammara brownii* Hort. ex Carr., Traité Conif., ed. 2: 625 (1867), nom. nud.; Decne & Naudin, Man. Amat. Jard. 3: 321 (1868), nom. nud.; non Guilfoyle (1862), i.e. *A. robusta*]

Loudon's text was actually written by Lindley (see p. iv and Gloag 1970: 56–7), but Lindley does not cite Lambert's publication with the species entry, so a specimen from Lindley's herbarium (CGE) would have been a good candidate as a type had there been any contemporary sheets there (there are not – Gina Murrell in litt.) and it seems that the description was based on the living plant in the Society's garden. Only in Lambert's second edition (1842: 104) is it recorded that such a plant was in the garden, and perhaps no specimen of the cultivated plant was made in any case. In the interests of stability, I therefore propose that the lectotype of *D. australis* be considered as neotype for *A. australis*, particularly as Lambert's book is cited on pp. X & 784 of Lindley's work.

2. Agathis lanceolata Warb.†, Monsunia 1: 186 (1900); Whitmore, Pl. Syst. Evol. 135: 60 (1980).

**Dammara lanceolata* Lindl. ex Sebert & Pancher, Rev. Marit. Colon. 40 : 555 (Feb 1874) & 41 :246 (Apr 1874) & Not. Bois Nouv. Caléd. 169 (1874), non Vieill. (1862), = *A. moorei* (Lindl.) Masters.

Type: New Caledonia, 'kaori des indigènes', *Fournier & Sebert 60 p.p.* in Herb. Colonies Franç. (P, **lecto!, selected here**).

Note that de Laubenfels (1972: 134) and Whitmore (1980: 60) have *Pancher s.n.*,'Cougui'[= Koghi Mts.], 1870, (P, n.v. [; iso- K (photo), P!]) as 'holotype', but the only material listed by Sebert and Pancher (in April 1874) is Fournier and Sebert's collection, which was presented to P in 1894, though one sheet labelled *D. ovata* under this number is referable to true *A. ovata* (see below).

**Dammara ovata* C. Moore [Cat. Bot. Gard. Syd 1857: 14 (1857), nom. nud.; ex Fowler, The Month 1: 293+ tab., nom. nud. (Nov 1857); ex Bennett, Gatherings Nat. Austral.: 353 (1860), nom. nud.] ex Seem., Fl. Vit.: 264 (Feb. 1868); Parl. in DC., Prodr. 16(2): 375 (July 1868), non Vieill. (1862) = *A. ovata* (Vieill.) Warb.

**Agathis ovata* (C. Moore ex Seem.) Maiden, Guide Bot. Gard. Sydney: 36 (1903), non (Vieill.) Warb. (1900).

Type: Growing at Botanic Gardens Sydney, collected 1861 (from the tree probably that still in Royal Botanic Gardens Sydney), *B. Seemann s.n.* (?K , not found, though perhaps sheets labelled 'Moore').

Seemann (l.c.) made herbarium specimens and took live plants of this and other of the seven supposedly different species in the collection with him to England, presented them to Kew, and made those, with his notes on the genus, available to Parlatore, who visited Kew in connexion with his account of the genus for De Candolle's *Prodromus*, hence Parlatore's remark '(v.v.)', i.e. live specimen seen [at Kew] as well as Moore! Bennett! [herbarium sheets at Kew]. There also survives wild-collected herbarium material from New Caledonia [or Isle of Pines (Bennett, l.c.)], *C. Moore* (CGE ['N. Caledonia' 'Moore', though mounted with 'D. ovata young' perhaps from the Sydney tree); P, photo], K, NSW ['New Caledonia', '1850', mounted with material of *A. moorei*].

[*Agathis obtusa* sensu Guillaum., Acta Horti Gothob. 19: 8 & fig. 4 (1952), non (Lindl.) Masters = *A. macrophylla* (Lindl.) Masters)].

†Why de Laubenfels (1972) attributes this name to 'Lindl. ex Warb.' is unclear. Although Warburg does not state the basionym, it is evident from his text that he is basing his new names in *Agathis* on those in *Dammara*. Lindley never used the name in either *Agathis* or *Dammara*, but Warburg's perpetrating Sebert's & Pancher's error indicates he was using their text, effectively creating a *nomen novum* in *Agathis* for *D. lanceolata* Sebert & Pancher, non Vieill. To correct Warburg's basionym to Vieillard's *D. lanceolata* would entail *A. lanceolata* falling in the synonymy of *A. moorei* (see below) and the necessity to provide a completely new name for the 'Koghis kauri', a highly undesirable outcome.

3. Agathis moorei (Lindl.) Masters, J. Roy. Hort. Soc. 14: 197 (1892); Dümmer, J. Roy. Hort. Soc. 39: 82 (1913); Whitmore, Pl. Syst. Evol. 135: 62 (1980).

Dammara moorei Lindl., J. Hort. Soc. Lond. 6: 270 (1851 as 'moorii'); Moore, Ann. Rep. 1852: 3, 7), non sensu Vieill., Ann. Sci. Nat. IV, 16: 56 (1862) = *A. corbassonii* de Laubenf.

Type: New Caledonia [Hienghène, Oct. 1850], *C. Moore 'N° 8'* (holo-, CGE, n.v.; iso-, K, NSW [New Caledonia '1850', mixed with *A. lanceolata*]).

**Dammara lanceolata* Vieill., Ann. Sci. Nat. IV, 16: 56 (1862), non 'Lindl.' ex Sebert & Pancher (1874) = *A. lanceolata* Warb.

Type: New Caledonia, 'Gatope', *Vieillard 1280, p.p.* (P, lecto [de Laubenfels (1972: 133)]).

4. Agathis ovata (Vieill.) Warb., Monsunia 1: 186 (1900), quoad basion., non *A. ovata* (C. Moore ex Seem.) Maiden (1903)†; Whitmore, Pl. Syst. Evol. 135: 63 (1980).

Dammara ovata Vieill., Ann. Sci. Nat. IV, 16: 56 (1862), Gordon, Suppl. Pinetum: 28 (1862), non [C. Moore ex] Seem. (1868) = *A. lanceolata* Warb.

Type: New Caledonia, Mts d'Unia, *Vieillard 1263* (P, lecto [de Laubenfels (1972: 142)]).

Dammara hypoleuca [Bull ex Anon., Gard. Chron. 1864: 654, nom. nud.; C. Moore ex] Henkel & Hochst., Syn. Nadelh.: 217 (1865).

Agathis hypoleuca (Henkel & Hochst.) Warb., Monsunia 1: 186 (1900).

Type: New Caledonia, 'Port Molle' [though this is in Queensland; according to Gardener's Chronicle 1861: 868 it was **Araucaria cunninghamii* Mudie (Pict. Austral.: 133, 148 [1829]) that came from Port Molle: perhaps this is a confusion], *C. Moore*, described from a juvenile plant (TUB, not preserved?).

[*Dammara pumila* C. Moore, Cat. Pl. Gov. Bot. Gard. Sydney 89 (1895), nom. nud.]

[*Agathis pumila* Maiden, Guide Bot. Gard. Sydney 41 (1903), nom. nud.]

†Warburg kept up both Moore's species , i.e. *D. ovata* (= *A. lanceolata*) and *D. hypoleuca* (though he considered that a *species dubia*). He used Moore's name as the source in *Dammara* of the basionyms, taking them from Parlatore's account (cited on p. 183). It could therefore be argued that his *A. ovata* was based, not on Vieillard's mistaken use of C. Moore's name, derisory 'description' and absence of a cited specimen, none of which Warburg cites, but on *D. ovata* C. Moore in the sense of all other authors. In that case *A. lanceolata* Warb. would become *A. ovata* Warb. (basionym: *D. ovata* C. Moore ex Seem., non Vieill.) and *A. ovata* '(Vieill.) Warb.' would be *A. hypoleuca* (Henkel & Hochst.) Warb., as Warburg had intended them to be. However the Code would appear to insist that Vieillard, whose three species are completely muddled up (his '*D. moorei* (*'moorii'*)' is *A. corbassonii*; his '*D. ovata*', though attributed to Moore, was not Moore's plant, and his only 'new' species, *D. lanceolata*, was true *D. moorei*!) be followed, in which case it has to be argued that Vieillard was describing a new species. As crude as Vieillard's elements are (and his description of *D. lanceolata* is no better, both being brief adjuncts to a description of his *D. moorei* (i.e. a different species, now *A. corbassonii*), one of a list of economically important New Caledonian plants), the requirements are there but, in citing an author (Moore), as with *D. moorei* (*'moorii'*) Lindley, it would seem not to have been Vieillard's intention to publish *D. ovata* as a new species in any case.

If, as seems inevitable in following the Code, *A. ovata* cannot be revived for Moore's *D. ovata*, and in the interests of stability it would be better not to transfer the name to another species and revive Moore's *D. hypoleuca* at this stage, then the consequence is that *A. lanceolata* stands.

5. **Agathis robusta** (F. Muell.) F.M. Bail., Syn. Qld Fl. 498 (1883); Warburg, Monsunia 1: 186 (1900), comb. superfl., illegit. [*D. brownii* Lem. in syn]; Barrett, Inst. Bot. Agric. [Buenos Aires] 1(19): 21 (1958); Hyland, Brunonia 1: 105 (1978); Whitmore, Pl. Syst. Evol. 135: 63 (1980); Hill, Fl. Austr. 48: 565 (1998).

Dammara robusta C. Moore [Ann. Rep. 1856: 3, 4 & 1857: 5, 6, nom. nud.; Cat. Pl. Govt. Bot. Gard. Sydney 14 (1857), nom. nud.; ex Fowler, Month 1: 293 cum tab. (Nov 1857), nom. nud.; ex Bennett, Gatherings Nat. Austral. 353 (1860), nom. nud.] ex F. Muell., Quart. J. Trans. Pharm. Soc. Vict. 2: 173 (1860); Seem., Fl. Vit. 264 (1868), ? excl. syn. *D. brownii*.

**Dammara bidwillii* [Shepherd ex Anon. in Syd. Morn. Herald 2 Oct. 1857: 5 (1857, as '*Dammarara bedwellii*'), nom. nud., & Mag. Sci. Art Sydney 1: 113 (1858), nom. nud.] Guilfoyle, Cat. Pl.: 14 (1862, as '*Bidwilli*') & Cat. Orn. Trees & Shrubs 1866: 16 (1866, as '*Bidwilli*'), nom. superfl. pro *D. robusta*.

Type: Probably cult. Darling Nursery, Chippendale, Sydney [*T.W. Shepherd s.n.*], Herb. Muell. MEL 258764 (MEL, lecto, selected here). Mueller's description of the female parts is based on 'the dissection of but a solitary fruit-cone' and only one such survives (Helen Aston *admot.* May 1990). Note that the only sheets I have seen bearing the name *Dammara bidwillii* (at K — from Gordon's herbarium) are referable to *A. australis*. It is not recorded that Bidwill collected that plant whilst in New Zealand.

[*Dammara* sp. (Wide Bay), Macarthur, Cat. Pl. Cult. Camden 1850: 10 (1850); Moore, Ann. Rep. 1853: 3 (1853)]

[*Dammara* sp. The Kaurie Tree of Wide Bay, Moore in NSW Exhibition Commissioners, Cat. Nat. Ind. Prod. NSW: 36 (1855)]

[*Dammara* sp. Le 'Kaurie Tree' de Wide Bay, Moore in Macarthur & Moore, Cat. Coll. Bois Indig.: 22 (1855)]

[*Dammara* sp. New Holland, C. Moore, Ann. Rep. 1855: 4–6 (1855)]

[*Dammara brownii* sensu W. Hill in Anon., Cat. Nat. Ind. Prod. Qld. 15 (1862), ?non Hort. Angl. ex Lem. (1855) ; there are Exhibition specimens so named at K]

[*Agathis brownii* sensu L. Bailey, Cult. Conif. N. Am. 151 (1933); Chitt., Dict. Gard. 1: 64 (1951), ?non (Lem.) L. Bailey]

An improved non-cryogenic transport and storage preservative facilitating DNA extraction from 'difficult' plants collected at remote sites

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Abstract

Thomson, J.A. (National Herbarium of NSW, Royal Botanic Gardens, Sydney, NSW 2000, Australia) 2002. An improved non-cryogenic transport and storage preservative facilitating DNA extraction from 'difficult' plants collected at remote sites. Telopea *9(4): 755–760.* Addition of 200 mM sodium ascorbate as an antioxidant to Rogstad's saturated NaCl-CTAB preservative extends the range of plant species from which good-quality DNA can be obtained without cryogenic transport and storage. The improved preservative is conveniently sent to collectors as a pre-weighed dry mix requiring only the addition of hot water.

Introduction

DNA of size and purity suitable for restriction analysis, cloning and selective sequence amplification using the polymerase chain reaction (PCR) is now routinely obtainable from most plant species if fresh, cryogenically stored, or freeze dried tissue at appropriate developmental stages is available. However, studies concerned with phylogenetic relationships, or with genetic resources and diversity, often depend on gathering, storage and transport of plant samples in remote localities where cryogenic facilities are unavailable. In such cases, procedures involving desiccation (Doyle & Dickson 1987) especially with silica gel (Chase & Hills 1991) and calcium sulphate (Liston et al. 1990), or pickling in NaCl-CTAB (saturated brine containing cetyl trimethylammonium bromide detergent/disinfectant; Rogstad 1992) have dramatically improved success rates in obtaining workable DNA. Nevertheless, there remain many intransigent species for which current non-cryogenic methods have proved inadequate.

Problems in obtaining good quality DNA are generally greatest when working with leaves or shoots rich in resins, mucilage/gums, and polyphenolics/tannins (Katterman & Shattuck 1983; Rogers & Bendich 1985; Pyle & Adams 1989; Couch & Fritz 1990; Rowland & Nguyen 1993). Major difficulties centre on irreversible cross-linking of DNA, often accompanied by the formation of pigmented adducts, and the tanning of chromosomal proteins to form an insoluble matrix from which only short DNA fragments, unsuitable for restriction analysis or for use as amplification templates, can be extracted. These processes commence with extreme rapidity, even at low temperatures (Couch & Fritz 1990), when cells are damaged by cutting and bruising during leaf harvest, and compartmentalisation breaks down (Loomis 1974). In addition, polyphenolics/polysaccharides that co-extract with DNA (Katterman & Shattuck 1983) may subsequently affect activity of processing enzymes such as restriction nucleases and *Taq* DNA polymerase (Štorchová et al. 2000).

During phylogenetic studies of ferns (Family Dennstaedtiaceae; Thomson 2000), tests of field-drying (Liston et al. 1990; Chase & Hills 1991) resulted in low yields of discoloured DNA of short fragment lengths. Preservation in NaCl-CTAB (Rogstad 1992) proved better, although DNA yields were variable and of unreliable quality. The

addition to NaCl-CTAB solution of an antioxidant such as sodium ascorbate is shown here to reduce degradative changes affecting the quality of DNA subsequently extracted from stored leaf tissue.

Materials and methods

Variables relating to the collection, storage, and DNA extraction in NaCl-CTAB based leaf preservative with and without 200 mM Na ascorbate as an antioxidant were assessed using field collected samples of bracken fern, *Pteridium esculentum* (G. Forst.) Cockayne from New South Wales, Australia, and of *Paesia scaberula* (A. Rich.) Kuhn from Auckland, New Zealand (Dennstaedtiaceae). Additional trials of the preservative containing Na ascorbate employed leaves of the monocotyledons *Anarthria humilis* Nees (Anarthriaceae) as well as photosynthetic stems of both *Georgeantha hexandra* B.G. Briggs and L.A.S. Johnson (Ectdeiocoleaceae) and *Alexgeorgea subterranea* Carlquist (Restionaceae). For the dicotyledon *Persoonia acicularis* F. Muell. (Proteaceae), the needle-like leaves were used.

The modified leaf preservative was provided to collectors as a pre-weighed dry-powder mix in square, autoclavable, leakproof, screwcap bottles of polypropylene (Style 2110, Nalge Company, Rochester, NY) of 60 ml or 175 ml capacity. Bottles were marked on the outside to indicate content levels of 50 or 150 ml respectively. Contents of the 60 ml bottles for 50 ml of preservative were 20 g NaCl, 2 g Na ascorbate, 1.5 g CTAB, 2 g silica gel desiccant; pro rata for 175 ml bottles to contain 150 ml of preservative. Silica gel desiccant was included to ensure the long-term stability of dry leaf-preservative mix not required for immediate use: uptake of moisture under humid conditions allows rapid oxidation of sodium ascorbate in air. Desiccant should be omitted if the leaf preservative is to be used promptly.

At least one day before the leaf preservative is required for use, freshly boiled hot water of drinking quality was added up to the indicated levels for the required number of bottles. Depending on the quality of the water available, sufficient boiling (>5 min) was recommended to achieve de-aeration, and as far as possible, demineralisation. The contents were stirred occasionally and tilted or rocked from side to side during cooling to facilitate dissolution. Shaking was avoided so as to minimise foaming and re-aeration.

For larger leaf samples, a single 60 or 175 ml bottle was used for each plant as appropriate. For smaller samples, the cooled preservative was aliquotted into appropriate vials. Leaves were cut as quickly as possible on site into pieces free from major veins and of suitable size to fit the container with minimal crushing and bruising, not exceeding one part of tissue to about four parts of preservative. A pencilled label on waterproof synthetic paper and a square of nylon or cellulose gauze was placed over the sample to keep it submerged in the preservative. Samples were kept in darkness at ambient temperature away from local heat sources for transport to the laboratory and storage over periods up to 6 months.

Soft, just unfurled bracken pinnae were preserved contemporaneously in both Rogstad's (1992) original NaCl-CTAB solution and in the modified formulation containing 200 mM Na ascorbate. Prior to DNA extraction 1, 2, 5, 10, 25, 50 and 100 weeks after collection, leaf pieces were thoroughly washed in cool tap water flowing through a nylon sieve, rinsed in distilled water and blotted dry. Two approaches to DNA extraction were used. The first employed Rogstad's (1992) double grinding protocol, involving an initial hot CTAB extraction after pulverisation using liquid

nitrogen, followed by regrinding with sand in the same buffer and re-incubation. The second method (Štorchová et al. 2000) utilised preliminary homogenisation of the leaf tissue in extraction buffer [0.34M sorbitol, 0.1M Tris-HCl at pH 7.6, 5mM EDTA, 1.0% v/v 2-mercaptoethanol] to remove polyphenolics, polysaccharides and other potentially interfering compounds before hot-CTAB extraction of DNA from the cellular residue. Crude DNA prepared by both approaches was assayed for fragment length and relative yield by agarose-gel using appropriate DNA standards. After final purification by silica binding, template competence of each DNA was assessed in PCRs. For Dennstaedtiaceae, multiple AP-PCR primers were used (Thomson 2000). For other species, amplification of the chloroplast *trn* L intron and *trn* L -*trn* F spacer (Taberlet et al. 1991) was tested.

Results and discussion

Darkening of bracken pinnulets close to the surface of NaCl-CTAB preservative not containing antioxidant was evident 12–24 hr after collection. Discolouration developed progressively with time, from the preservative meniscus downwards, for at least 4–6 weeks after collection. By this time many of the uppermost pinnulets in the preservative were brownish-green in colour. Pinnulets preserved in NaCl-CTAB containing 200 mM Na ascorbate remained light yellowish-green more than 2 years after collection. Some batches of ascorbate-containing preservative that had been made up using household salt developed a brownish discoloration in the storage medium over time, apparently due to decomposition of sodium or potassium ferrocyanide frequently present as an anti-caking agent in such salt. DNA extracted from these samples showed no apparent adverse effect.

Precise comparative evaluation of the yield and quality of DNA extracted from leaf samples is difficult due to between-sample variation reflecting differences in developmental age, physiological condition and handling (cutting, bruising, squashing) that may affect even different parts of the same lamina. Variability in the time taken to process samples, grinding pressure, temperature and shaking during extraction as well as deproteinisation efficiency also influence recovery of DNA.

The results of DNA extraction from bracken pinnae of comparable age and condition that had been silica-gel dried or pickled in either Rogstad's NaCl-CTAB or NaCl-CTAB-200 mM Na ascorbate are summarised in Table 1, with data for DNA extracted from freshly collected or freeze-dried tissue for comparison. Concomitant with the discoloration of bracken pinnulets in unmodified NaCl-CTAB, DNA extracted from this tissue became increasingly yellowish to brownish-yellow in colour over the first 5 weeks of storage, with a progressive decrease in the proportion of DNA of fragment length >20 kb (Table 1) and a parallel reduction in the success rate for AP-PCR with a range of primers (Thomson 2000) evident after clean up of the DNA by silica binding. In contrast, consistent yields of uncoloured DNA with fragment lengths predominantly about 25 kb were obtained from bracken pinnulets stored at room temperature in NaCl-CTAB-200 mM Na ascorbate for at least 25 weeks, and for at least 2 years when stored at –20°C after initial equilibration in preservative at ambient temperatures (cf. Rogstad 1992). Extraction of samples preserved in NaCl-CTAB-ascorbate using the method of Štorchová et al. (2000), without grinding under liquid N_2, typically resulted in slightly higher yields of DNA of longer fragment length than those obtained after grinding in liquid N_2. After clean up by silica binding, DNA from pinnae preserved in NaCl-CTAB-ascorbate consistently amplified successfully in PCRs (Table 1).

Table 1. The effect of tissue preservation and storage conditions on DNA extracted from young pinnae of sporophytes of *Pteridium esculentum*

Conditions	Extracted DNA			
	Yield	Colour	Length[1]	PCR[2]
1. Fresh tissue, liquid N_2	high	white	>25	reliable
2. Dried in silica gel[3], liquid N_2	low	yellow	0.5–5	useless
3. Freeze dried, dry milled	high	white	>25	reliable
4. NaCl-CTAB unmodified[3], liquid N_2				
1 week	low	yellow	20	variable
2 weeks	very low	orange	15–20	poor
5 weeks or more	very low	brownish	0.5–10	useless
5. NaCl-CTAB-ascorbate[4], liquid N_2				
1–100 weeks, ground × 1	low	white	>25	reliable
1–100 weeks, ground × 2	moderate	white	>20	reliable
6. NaCl-CTAB-ascorbate[4], sorbitol[5]				
1–100 weeks	moderate	white	>25	reliable

[1]predominant fragment length in kb estimated using gel electrophoresis; [2]ability to serve as template for PCR after standard clean up by silica binding; [3]kept at ambient temperature; [4]kept at ambient temperature up to 10 weeks, then — 20°C; [5]method of Štorchová et al. (2000).

DNA obtained from samples of *Alexgeorgea, Anarthria, Georgeantha* and *Persoonia* stored for approximately 4 weeks in NaCl-CTAB-ascorbate in each case supported successful PCR amplification of the chloroplast *trn* L intron and *trn* L -*trn* F spacer sequence (cf. Štorchová et al. 2000). In DNA studies of the Casuarinaceae, use of the NaCl-CTAB-ascorbate preservative has provided markedly improved reliability and product quality when compared with material dried in silica gel (Steane & Wilson pers. comm. 2001).

In situ damage to DNA in leaf tissue harvested for non-cryogenic storage can be minimised by avoiding more cutting and bruising than is essential to facilitate dehydration (as when using silica gel; Štorchová et al. 2000) or for cellular exposure to NaCl-CTAB (especially when preserving leaves with thick cuticles). Attention to minimising exposure of damaged tissue to air during transfer to NaCl-CTAB, and avoiding re-aeration of the preservative solution by shaking and frothing may also be helpful. Nickrent (1994) advocated addressing problems associated with non-cryogenic storage and transport by homogenising leaves in the field immediately after collection in buffered NaCl-CTAB containing antioxidants at 95°C, then incubating at 70–80°C for 30 min prior to transport and short-term storage at ambient temperatures. This treatment presumably both denatures the enzymes responsible for oxidative processes detrimental to DNA yield and quality, and also destroys deoxynucleases. However, as Štorchová et al. (2000) point out, this approach is not generally suitable for remote site collecting, especially as collecting of rare species may be necessarily opportunistic and/or may depend on collectors unpractised in such laboratory techniques.

Antioxidant additives, such as ascorbate at concentrations of 50–200 mM (Wendel & Weeden 1990), are effective in controlling loss of enzyme activity during preparation

of plant tissue extracts for isozyme studies (Loomis 1974; Kephart 1990; Wendel & Weeden 1990). This suggested the approach adopted here of including an antioxidant in Rogstad's saturated NaCl-CTAB preservative for plant tissue to be used for DNA extraction. Choice of Na ascorbate reflects its wide use in current DNA extraction buffers (e.g. Chase & Hills 1991; Nickrent 1994), low cost, stability during dry storage, heat decomposition temperature (218°C) compatible with the use of hot water to facilitate making up the preservative solution, and its relative stability at the pH of NaCl-CTAB solutions (about pH 5.5–6.0; Na ascorbate solutions oxidise readily in contact with air at pH >7).

Due to the bactericidal and detergent properties of CTAB, NaCl-CTAB field preservation not only avoids bacterial or fungal proliferation during relatively prolonged dehydration in air, but also facilitates careful cleaning of leaves during washing in the laboratory before DNA extraction.

The problems of poor DNA extractability after pickling in NaCl-CTAB, and the release into grinding buffers of high levels of polyphenolics, polysaccharides and other interfering substances including inhibitors of DNA processing enzymes, are effectively countered by preliminary homogenisation in a sorbitol wash buffer before hot CTAB extraction of DNA (Štorchová et al. 2000). These authors have shown that such a sorbitol-buffer wash extracts many polyphenolics, polysaccharides and other interfering substances without significant loss of DNA from the fragmented cellular material. Using the sorbitol-wash method, the yield of good quality DNA extracted from bracken fronds stored in NaCl-CTAB containing antioxidant was at least equal to that obtained with Rogstad's (1992) double-grinding procedure, and was more consistent from sample to sample.

When coupled with improvements to DNA extraction proposed by Štorchová et al. (2000), the addition of 200 mM Na ascorbate to Rogstad's saturated NaCl-CTAB leaf preservative increases opportunities for DNA studies of 'difficult' plant species from remote sites, especially those which may be available only opportunistically.

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A new species of *Glinus* L. (Molluginaceae) from the Northern Territory, Australia

P. S. Short

Abstract

Short, P.S. (Northern Territory Herbarium, Parks & Wildlife Commission of the Northern Territory, P.O. Box 496, Palmerston, NT 0831, Australia) 2002. A new species of Glinus *L. (Molluginaceae) from the Northern Territory, Australia.* Telopea *9(4): 761–763.* **Glinus sessiliflorus**, a species restricted to the Top End of the Northern Territory, is described and illustrated. It differs from other Australian species in having solitary, sessile flowers and two stamens per flower. A key to the four species of *Glinus* in Australia is provided.

Introduction

During compilation of an account of the family Molluginaceae in the Northern Territory it became apparent that an undescribed species of *Glinus* occurs in the Top End. It is described herein.

Species of *Glinus* L. are generally characterised by being herbs with flowers in axillary whorls or fascicles and by having seeds with a caruncle which terminates in a long, filiform appendage. These features are used to differentiate them from species placed in *Mollugo*, members of that genus having flowers borne in cymes or panicles and producing seeds which either lack a caruncle or have a very small caruncle which lacks an appendage. Perhaps not surprisingly *Glinus* is sometimes (Fosberg 1995) treated as a section of *Mollugo* and there may be merit in this action. However, as the aim of this paper is to simply make a formal name available for the species here described I have opted to follow the practice in current Australian State floras and accept *Glinus* as a distinct genus.

Taxonomy

Glinus sessiliflorus *P.S. Short*, **sp. nov.**

G. oppositifolius similis sed ei in floribus solitariis, sessilibus et in floribus staminibus binis differt.

Holotype: Northern Territory: Yinberrie Hills, Edith River area, 14° 04′ 58″S, 132° 04′ 58″E, common on alluvial clay depressions, 30 June 2000, *C.R. Michell 2504* (DNA 142356).

Isotype: CANB.

Annual herbs with prostrate stems to c. 12 cm long, with simple, white, straight to somewhat curled, spreading hairs scattered to dense on young growth. Leaves shortly to manifestly petiolate; petiole c. 0.5–11 mm long; lamina mostly circular to elliptic or very widely obovate to obovate, occasionally oblanceolate, 1–15 mm long, 0.8–5 mm wide, margins entire, with simple hairs as on branches. Flowers single, axillary, sessile. Perianth segments 5, free, elliptic to narrowly elliptic or obovate, 1.9–3 mm long,

0.6–1.1 mm wide; 2 or 3 segments mainly herbaceous but others with pronounced, whitish, scarious margins, the herbaceous parts of all segments sparsely to manifestly hairy. Stamens 2. Ovary glabrous, trilocular, placentation axile. Styles 3, sessile or almost so. Capsule 1.6–3 mm long, 3-valved, enclosed within the perianth. Seeds subreniform, 0.33–0.4 mm long, shiny reddish brown, smooth or tuberculate; with a white caruncle with a slender appendage around the periphery of the seed. Fruiting: June–Dec. (Fig. 1).

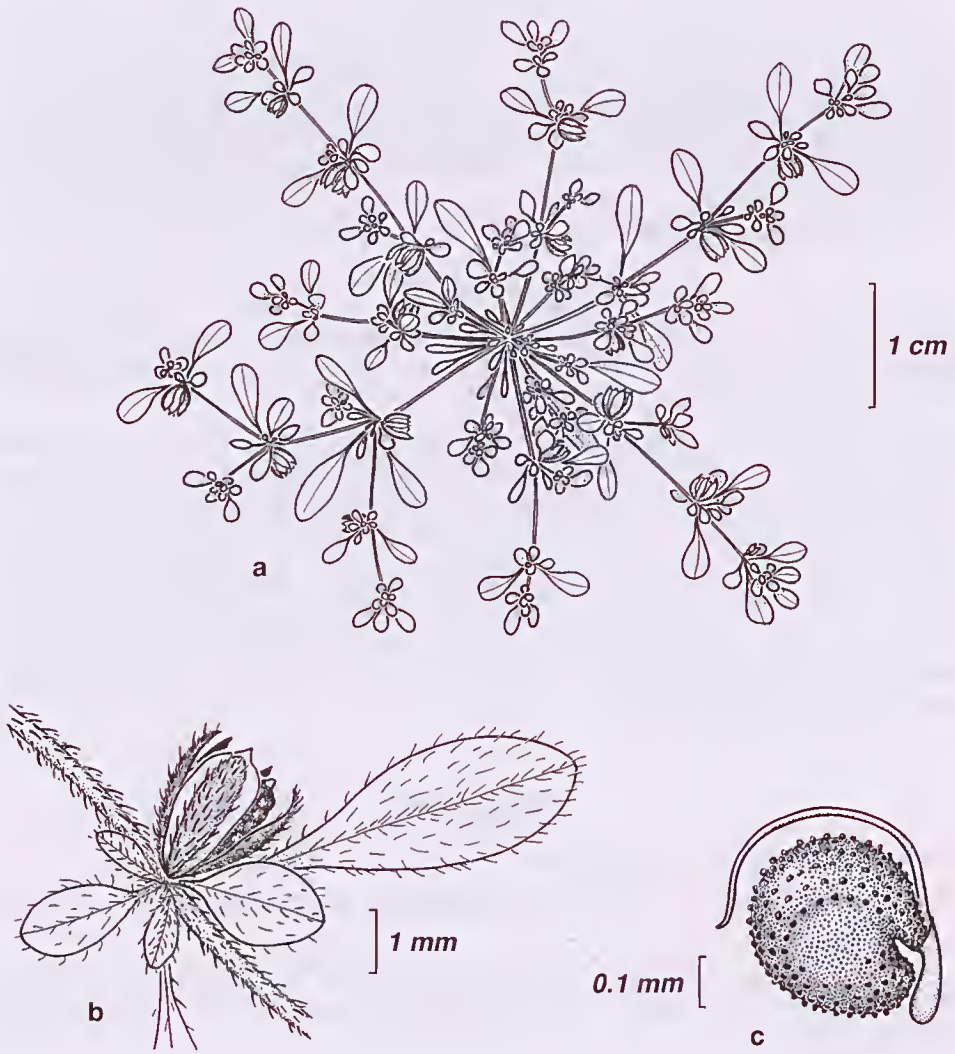

Fig. 1. *Glinus sessiliflorus*. **a**, habit; **b**, flowering node, the flower with a nearly mature capsule; **c**, seed. All illustrations from the type collection.

Etymology: the specific epithet reflects the sessile flowers, a key distinguishing feature of this species.

Distribution: confined to the Top End of the Northern Territory.

Habitat: at Ja Ja recorded from open grassland on the fringe of the floodplain and in the Edith River region in alluvial clay in a drainage depression.

Conservation status: possibly adequately conserved, with the Ja Ja and Nourlangie Rock populations in Kakadu National Park.

Notes: The few specimens of *G. sessiliflorus* in DNA have been previously housed under *G. oppositifolius*, a species known to occur in both Australia and Malesia (Backer 1951). In *G. oppositifolius* the flowers are usually in fascicles of 3–10, they are always distinctly pedicellate (the pedicels being 2–7 mm long), there are 3–5, not 2, stamens per flower and the leaves are generally much larger (10–35 mm long, 4–13 mm wide) and often glabrous.

Compared to those in other Australian species, the flowers of *G. sessiliflorus* are inconspicuous and have just two stamens per flower with the anthers in close proximity to the stigma. These attributes suggest a high degree of self-pollination.

Seeds from Kakadu localities have smooth surfaces but those from the Edith River area, which includes the type, have at least partly tuberculate surfaces. Further collections are required to see if this difference is consistent between northern and southern populations.

Other specimens examined: Northern Territory: near billabong at Nourlangie Rock, 12° 25'S, 130° 53'E, 13 Oct. 1973, *J. Burrell 1358* (DNA); Edith River area, 14° 04' 58"S, 132° 07' 01"E, 19 Aug. 1999, *C.R. Michell 2684* (DNA); Ja Ja, Kakadu, 14 Dec. 1979, *N. Sanderson (DNA 39331)*.

Key to species of *Glinus* L. in Australia

1. Young branchlets with an indumentum of stellate hairs ..... **G. lotoides**

1.* Young branchlets glabrous or with simple hairs 2

2. Flowers sessile, single and axillary; stamens 2 ..... **G. sessiliflorus**

2.* Flowers all or mostly on distinct pedicels and normally several in an inflorescence; stamens 3 or more 3

3. Stamens 3–5; perianth segments 3–4.5 mm long ..... **G. oppositifolius**

3.* Stamens 15–20; perianth segments 6–7 mm long ..... **G. orygioides**

Acknowledgments

I sincerely thank my wife Emma for the Latin diagnosis and Monika Osterkamp Madsen for the excellent illustration.

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Thismia clavarioides (Thismiaceae), a new species of Fairy Lantern from New South Wales

K.R. Thiele and P. Jordan

Abstract

Thiele, K.R.[1] *(Centre for Plant Biodiversity Research, CSIRO, GPO Box 1600, Canberra, ACT 2601, Australia) and Jordan, P. (1 Erith St, Bundanoon, NSW 2578, Australia) 2002.* Thismia clavarioides *(Thismiaceae), a new species of Fairy Lantern from New South Wales.* Telopea *9(4): 765–771.* A new species, **Thismia clavarioides**, is described, illustrated and compared with other Australian and similar extra-Australian species. A key to Australian species of *Thismia* is included, and the conservation status and affinities of the new species are discussed.

Introduction

Thismia Griffith is a small, poorly-known genus comprising c. 30 species of mycotrophic, leafless herbs. Centres of species and morphological diversity are in Malesia and tropical South America. Two species are temperate, *T. rodwayi* from south-eastern Australia and New Zealand, and *T. americana* in North America.

Thismia and a number of related genera are variously placed in Burmanniaceae (as the tribe Thismieae Miers. e.g. Conn 1994 following Cronquist 1981) or segregated into Thismiaceae (e.g. Bedford & Whalen 1993 following Dahlgren 1980). Jonker (1938), in a monograph of Burmanniaceae, treated all species known at that time, while Jonker (1948) treated all Malesian species for *Flora Malesiana*.

Jonker (1938) recognised seven genera in the Thismieae. Of these, the two African genera *Oxygene* Schltr. and *Afrothismia* Schltr. differ from *Thismia* in a number of significant morphological features, while the remaining genera (*Triscyphus* Taub. ex Warm., *Glaziocharis* Taub. ex Warm., *Geomitra* Becc. and *Scaphiophora* Schltr.) are separated on apparently trivial characters and probably would not be maintained as distinct in a modern classification. *Geomitra* was reduced to synonymy under *Thismia* by von Mueller (1890), and this status has been accepted recently by Stone (1980).

Two species of *Thismia* are currently described from Australia. *Thismia yorkensis* Cribb is known from two collections from rainforest on Cape York Peninsula in North Queensland (Cribb 1995). *Thismia rodwayi* F. Muell. has been recorded from widely scattered localities in Tasmania, Victoria, New South Wales, Queensland and the North Island of New Zealand (Curtis & Morris 1994; Given 1981; Cribb 1986; Conn 1994; Bedford & Whalen 1993). The New South Wales and Queensland records are based on a single specimen each, from Werrikimbe National Park (north-eastern NSW) and Kroombit Tops (Queensland). In addition, a fruit of an unidentified *Thismia* has been collected from the Lamington Plateau (South-East Queensland; Cribb 1986).

In June 2000 one of us (PJ) collected a fruiting specimen of *Thismia* from Coachwood (*Ceratopetalum apetalum*) rainforest near Bundanoon in the Southern Highlands of New South Wales. Flowering plants were subsequently found in the same area. Dissections of the flowering material and comparison with specimens of *T. rodwayi* and published

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descriptions and illustrations of other species shows that the Bundanoon plants comprise a new species, here described as *T. clavarioides*.

Thismia clavarioides *K.Thiele* **sp. nov.**

T. rodwayi similis sed floribus robustioribus, lobis interioribus perianthii mitriformibus unoquoque aristam dorsalem flexuosam erectam vel patentem robustam ferenti, et antheris caudis clavato-papillatis differt.

Holotype: Australia, New South Wales, Moreton National Park, Fairy Bower Falls, 3 Dec 2000, *P. Jordan NSW 447624* (NSW).

Achlorophyllous herb with a creeping, fleshy, vermiform rhizome to 2 mm diameter. Leaves alternate, reduced to colourless scales to 10 mm long, the uppermost enclosing the base of the flower. Flowers scarcely to fully emergent above ground level, solitary on sinuous scapes to 75 mm long, rather fleshy, colourless or the distal portions where emergent grading to dull pale orange; perianth to 65 mm long (including the dorsal processes on the perianth lobes); tube (6–)10–13(–16) mm long, (5–)8–9(–12) mm wide, narrowed just above the ovary and below the perianth lobes, inflated in the middle and broadest in the upper third, coarsely 6-ribbed, the ribs irregularly rugose; outer perianth lobes (3–)9–11(–14) mm long, erect or spreading and slightly recurved, each comprising an attenuate, cylindrical bristle enclosed for the lower two thirds by a prominent, recurved wing, the apex of the wing free and forming a small limb adaxially; inner perianth lobes thick, cuneate, broadly fused apically by their cuticles (inseparable without tearing) to form a mitreform hood above the mouth of the perianth tube with three arch-shaped openings, each with a prominent dorsal, fleshy, erect or spreading, flexuose, tentacle-like awn (8–)20–25(–43) mm long; stamens included, colourless; anthers extrorse, laterally connate into a ring hanging from a short, lobed corona at the mouth of the perianth tube, each with two shallow loculi, a fine, terminal bristle terminating in a club-shaped group of papillae, and a distal, three-lobed, skirt-like appendage sparsely margined with short, stiff hairs; nectaries (?) present on the anther appendages; style short, with three short, broad, shallowly bilobed, fan-like lobes; ovary inferior, flat-roofed, unilocular; placentas 3, free, fusiform, each joined at the apex and base of the loculus. Fruit c. 6 mm diameter, fleshy, whitish, ovoid, surmounted by a persistent thickened ring of perianth tissue and a persistent style-knob. Seeds golden-brown, globoid-ellipsoid, c. 0.3 × 0.25 mm, shallowly elongate-reticulate. (Fig. 1).

Derivation of epithet: derived from *Clavaria* (a genus of coral fungus) and the ending *–oides* (similar to), in allusion to the resemblance of the fleshy awns of the half-buried flowers to the coloured thalli of some coral fungi.

Key to the Australian species of *Thismia*

1 Mitre without processes; roots coralloid ..... **T. yorkensis**

1a Mitre with three apical or subapical processes; roots vermiform 2

2 Mitre-processes terminal, spreading or appressed to mitre , < 5 mm long; terminal bristle of anther simple ..... **T. rodwayi**

2a Mitre-processes dorsal, erect or spreading, usually > 20 mm long; terminal bristle of anther papillate-clavate ..... **T. clavarioides**

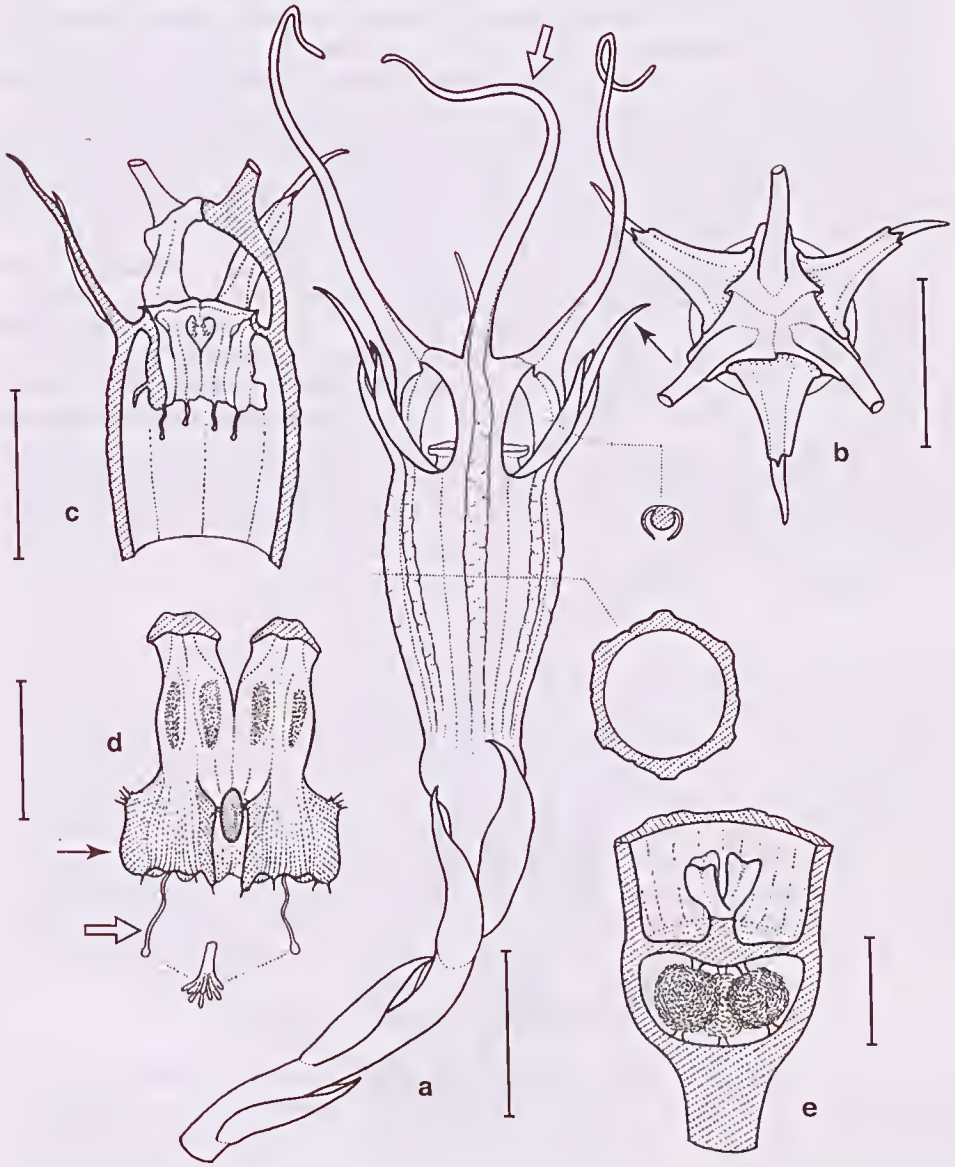

Fig. 1. *Thismia clavarioides*. **a**, flower, lateral view with ⇧ tentacle-like awn, and ↑ outer perianth lobe with cylindrical bristle enclosed by recurved wing. **b**, flower from above (tentacle-like awns truncated). **c**, perianth apex in section showing stamen ring. **d**, two detached stamens, extrorse face with ⇧ fine terminal bristle terminating in club-shaped group of papillae, and ↑ distal skirt-like appendage. **e**, ovary. Scale bars: a–c = 10 mm; d = 2 mm; e = 3 mm.

Discussion

Thismia clavarioides is particularly distinctive for the thick, attenuate, tentacle-like awns arising dorsally from the inner perianth lobes, which are fused by their cuticles to form a mitre. Many species of Malesian and South American *Thismia* and the Brazilian *Glaziocharis macahensis* have tentacle-like processes from the perianth lobes. These reach 30 mm in the Malesian *T. javanica* and *T. arachnites*, and 48 mm in *G. macahensis*. In all these species, however, the inner perianth lobes are free rather than mitreform, and the processes are terminal rather than dorsal. All species in which the inner perianth lobes are fully fused into a mitre lack tentacles, with the exception of *Thismia (Geomitra) clavigera*. The two species of *Scaphiophora* have a mitreform inner perianth terminated by a single, erect, 3-lobed column. This condition is clearly homologous with the tentacles of *T. clavarioides* and the Malesian *T. clavigera*.

Although a mitreform versus free inner perianth was considered a generic and section-level character by Jonker (1938), the states grade within the genus. *Thismia rodwayi* and *T. americana* are intermediate in having a mitreform inner perianth but with the perianth lobes connivent rather than connate and separable without tearing of tissue (Jonker 1938), or 'fused only where the fleshy ridges meet at the apex of the mitre, the free tips being interlaced or plaited' (Coleman 1936). In at least some specimens of *T. rodwayi* the inner perianth lobes cannot be easily separated, being glued by their cuticles and tearing on separation. Fully fused mitreform inner perianths are found in *Thismia* section *Sarcosiphon*, in *Thismia clavigera* and in *Scaphiophora* and *Glaziocharis*.

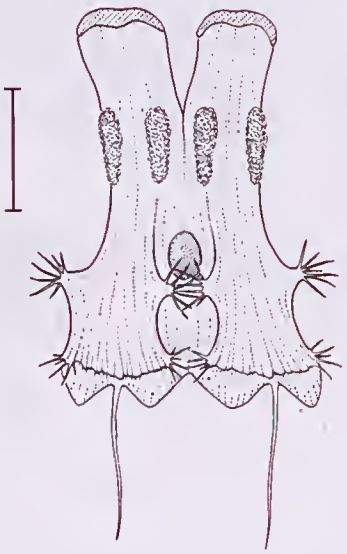

Fig. 2. Anthers of *T. rodwayi*, extrorse face. Scale bar = 2 mm.

The outer perianth lobes of *Thismia clavarioides* are distinctive. In most species of Thismiaceae these are simple and triangular or filiform; in *T. clavarioides* by contrast they are narrowly but distinctly winged, with the wings reflexed and partially wrapped around the central, cylindrical rib portion. The apex of the wing is free adaxially, forming a small limb. Jonker (1948, p. 23) describes the outer perianth lobes of the Sumatran *T. labiata* as 'broad-ovate at the base, rounded, with a subulate appendage inserted below the top'; this may be homologous, with the broad-ovate basal portion equivalent to the winged portion of *T. clavarioides*.

The shape and nature of the anther-ring provides useful characters in *Thismia*. Anthers in all species (except *T. hyalina*) have free filaments but are connate by their connectives to form a ring that hangs from a short, often thickened corona that partially occludes the throat of the perianth tube. The anther-loculi are shallow and extrorse. In *T. clavarioides* the anthers are distally winged, each anther bearing on the antrorse face two longitudinal lateral wings joined by a transverse, skirt-like wing. The filaments are broadly inserted on the corona with narrowly triangular gaps between them. The distal wings bear a few short, stiff hairs on their angles, and each anther is terminated by a single long, slightly flexuose, distally papillose-clavate bristle. On the suture between each pair of anthers distally is a prominent, glistening, ovoid glandular structure, possibly a nectary.

Possibly similar anther glands are described by Jonker (1948) for *Thismia javanica* and *T. gardneriana* and by Cribb (1986, 1995) for *T. rodwayi* and *T. yorkensis*. Distal anther wing-complexes are described for many Malesian species and for *T. yorkensis* (Cribb 1995), while a single, long, distal hair (but without the distal papillae) is found in *T. rodwayi* (see e.g. Conn 1994). The functions of these structures are unknown, but it is likely that they play an important role in pollination.

Pollinators of *Thismia* are unknown. Stone (1980) considered that flies are likely pollinators. In *T. clavarioides* and *T. rodwayi* the structure of the flower is reminiscent of the trap-structures of some species of *Pterostylis* (Orchidaceae) pollinated by fungus-gnats (although without an irritable trapdoor as provided by the *Pterostylis* labellum). A pollinator could enter the flower through the arch-shaped windows in the mitre, then descend into the perianth-tube through the hole in the corona and anther-ring. Once in the tube, the pollinator may be constrained by the wing-complexes on the anther-ring to leave the flower by climbing the inside wall of the perianth and forcing through the gaps between the anther filaments. This would bring the insect in contact with pollen from the extrorse anther-loculi. The function of the apparently glandular structures on the anthers is unknown.

Relationships of *Thismia clavarioides*

Until a detailed phylogenetic analysis of *Thismia* and its allies is undertaken, relationships of the species are largely unknown. The generic and infrageneric classification of Jonker (1938) appears inadequate. In his classification, *T. clavarioides* would probably fall into *Geomitra* (containing the single species *G. clavigera* = *Thismia clavigera*). Superficially, flowers of *T. clavarioides* appear similar to those of *T. clavigera*, but that species has minute, triangular outer perianth lobes, and inner perianth lobes with erect tentacles arising from a central point on the mitre rather than dorsally from each lobe. The anthers of *T. clavigera* lack the distal wings and central hair of *T. clavarioides*. Vegetatively, *T. clavarioides* and *T. clavigera* are very different, the latter having coralliform, fan-shaped roots, and many leaves and flowers on each stem.

In vegetative and internal floral morphology *T. clavarioides* is very similar to *T. rodwayi*, and is probably closely related to it. In particular, the anther appendages of the two species are almost identical (Figs 1d, 2). A number of specimens of *T. rodwayi* examined

at MEL differed from *T. clavarioides* in having larger, deeply coloured, slightly more robust anthers but with thinner and more erose distal wings, more prominent groups of stiff hairs on the angles of the wings, and with the terminal hairs lacking papillose-clavate tips. The paucity of good material, however, makes it difficult to assess the range of variation in these features.

Mueller (1890), in reporting the discovery of *T. rodwayi*, expressed astonishment at finding a *Thismia* in temperate Australia. Jonker (1938) placed *T. rodwayi* with the Northern Hemisphere temperate *T. americana* in Section Rodwaya Schltr. Indeed, Jonker (loc. cit. p. 12) considered that the two species may be identical. Many authors have since commented on these surprising systematic and biogeographic anomalies (e.g. Coleman 1941; Campbell 1968; McLennan 1958; Scarlett & Parsons 1993). However, *T. americana*, as best can be determined from the descriptions and illustrations of the single known specimen, differs from both *T. rodwayi* and *T. clavarioides* in having no appendages on the anther connectives, a geniculate perianth tube and in having all perianth parts of approximately equal size. It is almost certainly not closely related.

Distribution, habitat and conservation status

Thismia clavarioides is currently known from only a small area in Morton National Park near Bundanoon. Two clusters of plants c. 50 m apart have been located, one covering an area approximately 2.5 m × 2.5 m, the other smaller. Since the rhizomes are thin and difficult to trace without disturbing the plant, it is impossible to determine whether each of these patches comprises a single clone. In the larger patch c. 15 flowers were observed in Spring 2000, while only 3 flowers were observed in the smaller patch. Flowers varied in their degree of emergence from the leaf litter, but most had the perianth tube below litter level with only the mitre and tentacles showing,

Both patches are in Coachwood (*Ceratopetalum gummiferum*) rainforest in humus-rich, colluvial soil and leaf litter over Hawkesbury Sandstone, on a south-facing slope near a stream. Associated species include *Acmena smithii, Backhousia myrtifolia, Eucryphia moorei, Tristaniopsis laurina* and various ferns. Since this vegetation is relatively extensive along gully bottoms and on sheltered aspects in the area, it may be expected that there are other populations yet undiscovered. The species may be locally common, but its cryptic nature makes this difficult to determine without further surveys.

Given the cryptic habit of *T. clavarioides* and uncertainty over its status and likely distribution, we consider that it should be given a conservation rating of 2Kcit (Briggs & Leigh 1996). While its low known population number would warrant a status of Critically Endangered under the IUCN Red List categories (IUCN 1994), this is probably premature until further surveys of suitable habitat are conducted.

Acknowledgments

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Eucalyptus castrensis (Myrtaceae), a new species from New South Wales

K.D. Hill and L.C. Stanberg

Abstract

Hill, K.D. and L.C. Stanberg (National Herbarium of New South Wales, Royal Botanic Gardens, Mrs Macquaries Road, Sydney, NSW 2000, Australia) 2002. Eucalyptus castrensis *(Myrtaceae), a new species from New South Wales.* Telopea *9(4): 773–776.* A new species, **Eucalyptus castrensis** from New South Wales, is described and illustrated. A comparison with *E. aenea* is provided, and conservation status is discussed. This species is regarded as vulnerable.

Introduction

Recent vegetation surveys of defence forces land near Singleton, New South Wales, have revealed a number of rare and unusual occurrences. One of these, a new species of *Eucalyptus* in the grey box group (Series *Subbuxeales* Blakely, sensu Chippendale 1988) allied to *E. aenea* is described here. It is classed as vulnerable, and a formal name is required in order to facilitate appropriate listing and action for conservation purposes.

Eucalyptus castrensis *K.D.Hill*, **sp. nov.**

E. aenea affinis sed foliis adultis longioribus latioribusque, foliis juvenilibus latioribus, fructibus alabastrisque majoribus, calyptra constricto differt.

Type: New South Wales: North Coast: Singleton Army Base, 1.5 km NE of Broken Back repeater station, block on S side of Pokolbin-Broke road, *K.D. Hill 5632 & L.C. Stanberg*, 31 Oct 2000 (holo NSW; iso BRI, CANB, MEL, AD, UNE, DNA, K).

Mallee to 8 m tall. Bark smooth, bronze-grey, shedding in ribbons, with thin dark grey box bark on lower parts of largest stems. Juvenile leaves blue-green, dull, disjunct-opposite, ovate to lanceolate, 60–115 mm long, 15–40 mm wide; petioles 2–12 mm long. Adult leaves glossy green, disjunct-opposite, similifacial, lanceolate, acute or apiculate, 60–130 mm long, 8–22 mm wide; petioles 4–15 mm long. Inflorescences axillary and single; umbellasters 7-flowered. Peduncles terete, 7–10 mm long. Pedicels terete, 1–5 mm long. Mature buds ovoid, 5–6 mm long, 2–4 mm diam. Calyptra conical, acute, apically rounded, medially constricted and broadly beaked, up to $^3/_4$ as long as long as hypanthium. Outer calyptra persistent to anthesis. Stamens all fertile, filaments irregularly arranged in bud. Anthers adnate, basifixed, cuboid to globoid, opening by lateral pores. Fruits cup-shaped, 4-locular, 4–5 mm long, 4–6 mm diam. Calyptra scar and stemonophore flat, <0.2 mm wide. Disc steeply depressed, 1–1.5 mm wide. Valves broadly triangular, obtuse, deeply enclosed, strongly raised and appressed against disc. Fig. 1.

Notes: the mallee habit, the broad juvenile leaves, the axillary inflorescences and the persistent outer calyptra place *E. castrensis* nearest to *E. aenea* K.D. Hill (Hill 1997). It is distinguished from *E. aenea* by longer and wider adult leaves, broader juvenile leaves, larger fruit, and larger buds with conical, medially constricted calyptras (Fig. 1, Table 1). *Eucalyptus castrensis* also grows into a taller tree than *E. aenea* and retains a little persistent box bark near the base of the trunk in larger trees (not seen in *E. aenea*).

Fig. 1. *E castrensis.* **a**, juvenile leaves; **b**, adult leaves; **c**, inflorescence; **d**, buds; **e**, anther; **f**, transverse section of bud; **g**, fruit. (a,b,g, from *Hill 5632 et al.*, c-f from *NSW 444861*). Scale bar: a, b = 60 mm; c = 40 mm; d = 12.5 mm; e = 2 mm; f = 6 mm.

Table 1. Comparison of *E. castrensis* and *E. aenea*.

	E. castrensis	*E. aenea*
Adult leaf	lanceolate	lanceolate
Length mm	60–130	50–110
Width mm	8–22	9–18
Juvenile leaf	ovate to lanceolate	lanceolate
Length mm	12–115	5–80
Width mm	5–40	7–18
Petiole (L mm)	4–15	6–10
Buds (L × W mm)	5–6 × 2–4	4–6 × 2–3
Fruit (L × W mm)	4–5 × 4–6	3–5 × 3–5
Peduncle (L mm)	7–10	4–7
Pedicel (L mm)	1–5	1–3
Calyptra shape	conical, constricted about the middle	hemispherical, sometimes shortly apiculate

Distribution: known only from a single stand in Singleton Army Base near Broken Back repeater station (32°45'S 151°14'E). This occurrence is about 100 km east from the nearest occurrence of the closely related *E. aenea* in the Goulburn River National Park.

Ecology: locally dominant but restricted, occurring as a dense single stand over c. 3 ha. on a low broad ridge top on loam over sandstone. Understore consists of grasses and scattered shrubs, with bare ground and litter. *Eucalyptus fibrosa* and *Corymbia maculata* are growing adjacent to, but not within, the mallee stand.

Conservation status: known from the single population at the type locality. It is on Commonwealth defence forces land, with an informal commitment from the defence forces to preserve the site. In the absence of formal reservation, the site remains potentially vulnerable. The appropriate ROTAP code is 2V (Briggs & Leigh 1996).

Etymology: the epithet is from the Latin *castra*, an encampment, usually of a military nature and the Latin termination *-ensis*, pertaining to, from the occurrence of this species in the grounds of the Singleton Army Base.

Selected specimens (from 5 examined): New South Wales: North Coast: Singleton Army Base, 1.5 km NE of Broken Back repeater station, block on S side of Pokolbin - Broke rd, *Hill 5633, 5634 & 5635 & Stanberg*, 31 Oct 2000 (CANB, BRI, MEL), *Bell s.n.*, 23 Aug 2000 (NSW444861).

Acknowledgments

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The genus *Anomobryum* Schimp. (Bryopsida, Bryaceae) in Australia

John R. Spence and Helen P. Ramsay

Abstract

Spence, John R.[1] and Ramsay, Helen P.[2] ([1]National Park Service, Glen Canyon NRA, PO Box 1507, Page, AZ 86040, USA; [2]National Herbarium of New South Wales, Mrs. Macquaries Road, Royal Botanic Gardens, Sydney, NSW 2000, Australia) 2002. The genus Anomobryum *Schimp. (Bryopsida, Bryaceae) in Australia.* Telopea *9(4) 777–792.* The genus *Anomobryum* has been revised for Australia and five species are recognized: *A. auratum* (Mitt.) A. Jaeger, *A. harriottii* (R. Br. bis.) Dixon, *Anomobryum sp.* (= *Bryum argenteum* Hedw.), and two new combinations made for species transferred from *Bryum*: **A. lanatum** (P. Beauv.) J.R. Spence & H.P. Ramsay, and **A. subrotundifolium** (A. Jaeger) J.R. Spence & H.P. Ramsay. Keys, descriptions, illustrations and distributions are presented for the species in Australia. Relationships with other genera in the Bryaceae are discussed.

Introduction

In this study the genus *Anomobryum* (Bryaceae) has been examined in detail as a contribution for the Flora of Australia. *Anomobryum* is closely related to the widespread genus *Bryum* and most bryologists (e.g. Smith 1978, Crum & Anderson 1981, Noguchi 1994, Eddy 1996) consider it a separate genus, although Ochi (1970, 1992) retained it as a subgenus within *Bryum*. In general *Anomobryum* is distinguished by its very small size, julaceous stems, and leaves with a weak costa and smooth margins, all features that it shares with the silver *Bryum* species, such as *B. argenteum* Hedw. At least two species of *Anomobryum* are also silver in colouration like *B. argenteum* and its allies. The sporophyte generation in *Anomobryum* is remarkably variable in capsule shape and orientation. Peristomes are also extremely variable, and in some cases reduced to a single rudimentary layer, the origin of which remains unknown (Shaw & Fife 1984). Within the *Bryum argenteum* group similar capsule and peristome variability also exists (Tan & Koponen 1989).

Bryum argenteum was selected as the lectotype for the genus *Bryum* (E.G. Britten, 1918 Fl. Bermuda: 490). For reasons outlined in Spence and Ramsay (1999) we consider this an unfortunate choice for the type and have proposed that this be rejected and the genus be assigned a new type based on *Bryum caespiticium* Hedw. Although the species *B. argenteum* is treated as an *Anomobryum* for this study, the formal transfer will not be made until the Committee for Bryophyta has made a decision regarding the proposal. For arguments regarding the relationships of *B. argenteum*, see Spence and Ramsay (1999).

In this paper a full taxonomic treatment of *Anomobryum* for Australia is presented, with illustrations and keys. A discussion of the genus world-wide and its relationships with other members of the Bryaceae is included. Currently, we recognize five species of *Anomobryum* in Australia, of which three (two transferred from *Bryum*) have the silver coloration typical of *Bryum argenteum*. The five species recognised here are *A. sp.* (=*B. argenteum* s.s.), *A. auratum*, *A. harriottii*, *A. lanatum*, and *A. subrotundifolium*.

Taxonomic treatment for Australia

Anomobryum Schimp., Syn. 382, 1860.

Type: *A. julaceum* (Gaertn., Meyer & Scherb.) Schimp.

Synonyms: *Bryum* Hedw. subgen. *Anomobryum* (Schimp.) Schimp., *Syn.* edn 2: 465 (1876).

Derivation: from the Greek, *anomo-* (different) and *bryum* (moss), in reference to differences from true *Bryum*.

Dioicous. Plants small in dense turfs on damp soil and rock. Stems 1–4 mm, julaceous, often branched by innovations; leaves small, mostly under 1.0 mm long, imbricate, obtuse to apiculate, margins mostly plane, unbordered; upper and mid-laminal cells rhomboidal to elongate-vermicular (3–10: 1 or more), often thick walled, lower laminal cells abruptly quadrate to short-rectangular (1–2: 1), wider than cells above; costa weak, not reaching apex to percurrent, rarely shortly excurrent, in cross-section lacking distinct guide cells; gemmae as leafy bulbils often found in leaf axils of sterile shoots. Perigonial and perichaetial leaves somewhat differentiated, somewhat enlarged and often with acute apices. Calyptra cucullate, shed early. Seta long-exserted, to 1.2 cm; capsule small, <1mm, shape variable, ovate with thickened neck to cylindric with narrowed neck, pendulous to erect; peristome double, highly variable, from well developed with both exostome and endostome, to endostome segments reduced with low basal membrane, cilia reduced or absent, or rarely peristome almost lacking. Spores small, 8–20 μm. n = 10, 11, 12, 20 (Fritsch 1991).

A worldwide genus of c. 50–60 species, most common in montane regions of the subtropics, tropics and the southern hemisphere, especially well represented in the neotropics. Only a few species occur in temperate areas of the northern hemisphere. The genus is represented in Australia and its territories by five species.

Key to species

1 Plants silvery; upper portions of leaves lacking colouration, costa variable, weak to excurrent 2

1* Plants brown or green, not silvery; upper leaves green, costa weak, not reaching apex 4

2 Leaf apex obtuse or rarely slightly apiculate, apiculus <3μm long; leaves often cucullate; basal lamina cells predominantly short-rectangular (2: 1), upper-middle lamina cells wide (>14 μm) 2–3: 1 length:width ratio ..... **5. A. subrotundifolium**

2* Leaf apex apiculate to acuminate, hairpoint or apiculus >8μm; leaves not cucullate; basal lamina cells predominantly quadrate, upper and mid lamina cells narrow (<10 μm) 3

3 Costa percurrent, upper leaf abruptly contracted to apiculus ..... **1. A. sp. (=Bryum argenteum)**

3* Costa strong, excurrent in hairpoint; leaf acuminate ..... **4. A. lanatum**

4 Upper lamina cells elongate-vermicular (>6: 1) ..... **2. A. auratum**

4* Upper lamina cells short and broad (2–3: 1) ..... **3. A. harriottii**

1. Anomobryum sp.

Bryum argenteum Hedw., *Spec. Musc.* 181 (1801).

Type: Europe; holo ?G, n.v.

Bryum argenteum var. *niveum* Wils., *Fl. Tasm.* 2: 191 (1859).

Type: Tasmania: Hobart (Surrey Hills) *Gunn* 1615; holo MEL.

Bryum amblyolepis Cardot *Rev. Bryol. Lichenol.* 27: 45 (1900).

Type: South Africa; holo ?PC, n.v.

Bryum amblyophyllum Cardot A.N.A.R.E. Rep. ser. B. Bot. 4 (1953) *orthogr. pro B. amblyolepis* Cardot.

Bryum catenatulum Müll. Hal. *Proc. Linn. Soc. New South Wales Suppl.* 30: 142 (1906) *nom. nud. in synon.*

Based on: Queensland: no locality, no collector (MEL); Victoria: Mt Ararat no collector [not located].

Bryum hampeanum Müll. *Hal. Gen. Musc. Fr.* 217 (1901) nom. nud. in synon.

Based on: Victoria: Mt Ararat no collector [not located].

Illustrations: (all as *Bryum argenteum*) Smith fig. 401, p. 422 (1978); Catcheside fig. 159, p. 269 (1980); Crum and Anderson fig. 265 (A–G), p. 571 (1981); Noguchi fig. 213, p. 485 (1994); Eddy fig. 410, p. 121 (1996).

Plants small, in dense turfs, glossy silver-green when moist, silvery-hyaline when dry. Stems julaceous, fragile, crowded, 0.5–1.5 cm tall, branching by numerous subperichaetial innovations. Leaves ovate to ovate-lanceolate, 0.5–1.5 mm long, concave, imbricate, tapered somewhat abruptly to an apiculus or occasionally apices obtuse; upper portion ($^1/_2$–$^1/_4$) of lamina hyaline, margins plane, mostly unbordered; costae weak, percurrent or not reaching apex, in cross-section lacking guide cells and with a reduced stereid band; upper and mid laminal cells rhomboid-hexagonal, 40–70 µm long (3–5: 1), thin or firm-walled, basal laminal cells predominantly quadrate, thin-walled. Gemmae as bulbils often present in leaf axils of sterile stems. Perichaetia on short stems, leaves apiculate. Seta 1.2–2.0 cm long, red; capsule short <2 mm long, pendulous, ovate with thick often wrinkled neck, abruptly contracted to seta, bright red at maturity, opercula convex, apiculate; peristome double, exostome teeth 16, with narrow border, tapering to pale tip, outer face finely papillose; endostome segments 16, with narrow gaps, basal membrane $^1/_2$ height of exostome teeth, cilia 1–3, nodose to short-appendiculate. Spores small 8–15 µm. n=10 (fide Ramsay & Spence 1996). (Fig. 1a–g).

Habitat: *Anomobryum sp.* (= *Bryum argenteum*) is especially common in disturbed habitats, pavements, walls, soil, rock crevices particularly in anthropogenic localities such as cities and towns. It prefers calcareous habitats and places that are high in organic nitrogen.

Distribution: a cosmopolitan species, common throughout Australia (W.A., N.T., S.A., QLD, N.S.W., A.C.T., VIC, TAS.). Fig. 6a.

Selected Specimens: Western Australia: Porongarups, *G.G. Smith s.n.*, 6 Oct 1959 (MEL ex WAU); Dundas Rocks, *D. Kemsley s.n.*, 21 Oct 1951 (MEL); Mt Barker, *G.D. Mills s.n.*, Aug 1946 (MEL ex WAU); Walpole-Nornalup N.P., *D.H. Norris 26197* (BRI).

Northern Territory: Mt Connor, *J.H. Willis s.n.*, 17 Jan 1974 (MEL); Mt Ruddock, Harts Range, A.C. *Beauglehole 44658* (MEL); Mt Connor, A.C. *Beauglehole 22866* (MEL); Ayers Rock (=Uluru), A.C. *Beauglehole 25880* (MEL).

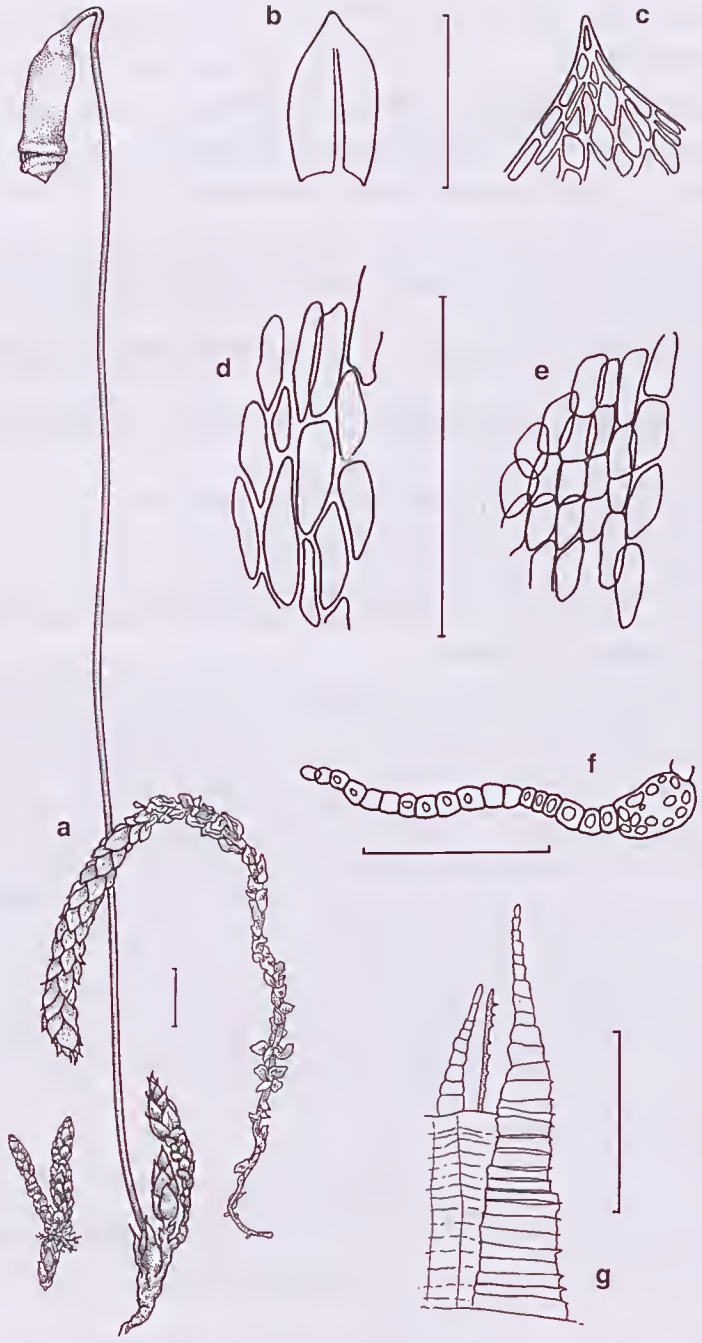

Fig. 1. *A. sp. (=Bryum argenteum).* **a,** range of habits (dry) mid plant with sporophyte attached; **b,** leaf; **c,** apical leaf cells; **d,** mid-laminal cells; **e,** basal lamina cells; **f,** T.S. leaf; **g,** peristome. (a, b–e from *W.B. Schofield 80124* (NSW); a, with sporophyte from *D. Sullivan s.n.* 1872–1890 (MEL); f–g from *H.P. Ramsay 3/77* (NSW)). Scale bars: a = 1.0 mm; b = 0.5 mm; c–g = 100μm.

South Australia: Kensington Park, Adelaide, *D.G. Catcheside 79.155*, Oct 1979 (AD); Fowlers Bay, *Mrs Richards s.n.* (MEL); Adelaide, *F.V. Mueller s.n.*, Jun 1852 (MEL); Bute Yorke Peninsula, *B. Copley 797* (AD).

Queensland: Millaa Millaa, *E. Henry s.n.* (CANB); Lake Eacham *D.G. Catcheside 76.76* (AD); Tinaroo Perimeter Road, *H. Streimann 16985* (CANB); Tumoulin Rd, northwest of Ravenshoe *H. Streimann 27070* (CANB); Big Tableland, *H. Streimann 30829* (CANB); Atherton, *H. Streimann 29166* (CANB); Tinaroo Dam, *W.B. Schofield 80214* (NSW); Mt Bellenden Ker, *H. Streimann 27446* (CANB); Lamington N.P., *J.R. Spence 5197* (NSW); Kogan, *M.E. Ballingall s.n.*, 17 Mar 1985 (BRI); Mt Glorious, *J. Sawyer and E.M Ross s.n.*, 13 May1985 (BRI); Purlingbrook, *J. Sawyer and E.M. Ross s.n.*, 22 Jul 1987 (BRI).

New South Wales: Between Rous and Wardell, *H.P. Ramsay R530* (NSW); Hume (Murray) River, *S. Jeffcott s.n.*, 1886 (MEL); Broken Hill, *A.B. Court s.n.*, Jun 1955 (MEL); Warrumbungles, *I.G. Stone 4059, 4063* (MEL); Tinderry, *H. Streimann 5215* (CANB); Cobar Regeneration Area, *D.J. Eldridge BSCS 738 with M.E. Tozer* (NSW); 4.3 km SW of Nymagee on Gilgunnia Rd, *D. J. Eldridge BSCS 581 with M.E. Tozer* (NSW); Yathong Nature Reserve, *D.J. Eldridge BSCS 64* (NSW); 9 km NE of Tchelery Homestead, *D.J. Eldridge BSCS 641 with M. E. Tozer* (NSW).

Victoria: Grampians, *D. Sullivan s.n.* (MEL); Wilsons Promontory, *I.G. Stone 645* (MEL); Euroa-Mentone Road, *I.G. Stone 9001* (MEL); Raywood, *I.G. Stone 1705* (MEL); Mt Buffalo, *I.G. Stone 7798* (MEL); Grampians, *I.G. Stone 9165* (MEL); Gorae West, *A.C. Beaglehole 1479* (MEL); Kulkyne, *J.H. Willis s.n.*, 16 Oct 1960 (MEL); Studley Park, *F.M. Reader s.n.*, 5 Sep 1883 (MEL); Creswick, *J.H. Willis s.n.*, 26 Jul 1942 (MEL); Melbourne University, *H.T. Clifford s.n.*, Jun 1947 (MEL).

Tasmania: Cataract Gorge, Launceston (no collector), Aug 1886 (MEL).

Notes: The species *Bryum argenteum* should be transferred to *Anomobryum* for reasons outlined above and in Spence and Ramsay (1999). Although Eddy (1996) comments on the similarity between the stems of this and *Anomobryum* species, he considers that the lack of apiculi (present, however, in *Bryum argenteum* var. *lanatum*), and differences in habitats exclude it. *Bryum argenteum* is a cosmopolitan species which has probably been introduced into many parts of the world. Its abundance in cities in developed landscapes and other disturbed habitats along with its general absence from native vegetation, suggests that it may have been introduced into Australia. Several unpublished varietal names appear on specimens, e.g var. *proliferum* (for those with bulbils), but these merely represent variability of characters within the species and do not represent separate taxa. Differences between this and the two other Australian silver species, *A. lanatum* and *A. subrotundifolium* are discussed under them.

2. Anomobryum auratum (Mitt.) A. Jaeger, *Ber. S. Gall. Naturw. Ges.* 1873–74: 142 (1875) (Ad 1: 804).

Bryum auratum Mitt., *Linn. Soc. Bot. Suppl.* 1: 67 (1859).

Type: Nepal, Lamben River, 7000 ft., *J.D. Hooker 513* ; holo ?BM; syn NY.

Illustrations: Ochi, p. 157 fig. 36 (1969).

Plants small in dense golden-brown turfs. Stems to 5–7.0 mm tall, julaceous, branching by numerous subperichaetial innovations. Leaves broadly ovate, concave, 0.4–0.8 mm long, with apiculate to obtuse apices, margins plane, unbordered; costae weak, $^1/_2$–$^2/_3$ length of leaf, lacking guide cells; upper laminal cells short rhomboidal, 10–15 μm × 1–2 μm (2–3: 1), mid-laminal cells elongate-vermicular, 30–45 μm × 6–8 μm (6: 1 or more), walls thick-walled; lower cells lax, quadrate to short-rectangular. Gemmae not known. Australian collections sterile. Seta short; capsule short-ovate, red when mature, horizontal to sub-erect; endostome and cilia rudimentary, not well developed. Spores 11–13 μm. (description of sporophyte taken from Ochi, 1969). No chromosome number available. (Fig. 2a–f).

Habitat: extremely rare and local. First recorded in Australia from a single collection in Queensland by Watts (Brotherus & Watts 1918) as *A. cymbifolium* from 'Millstream

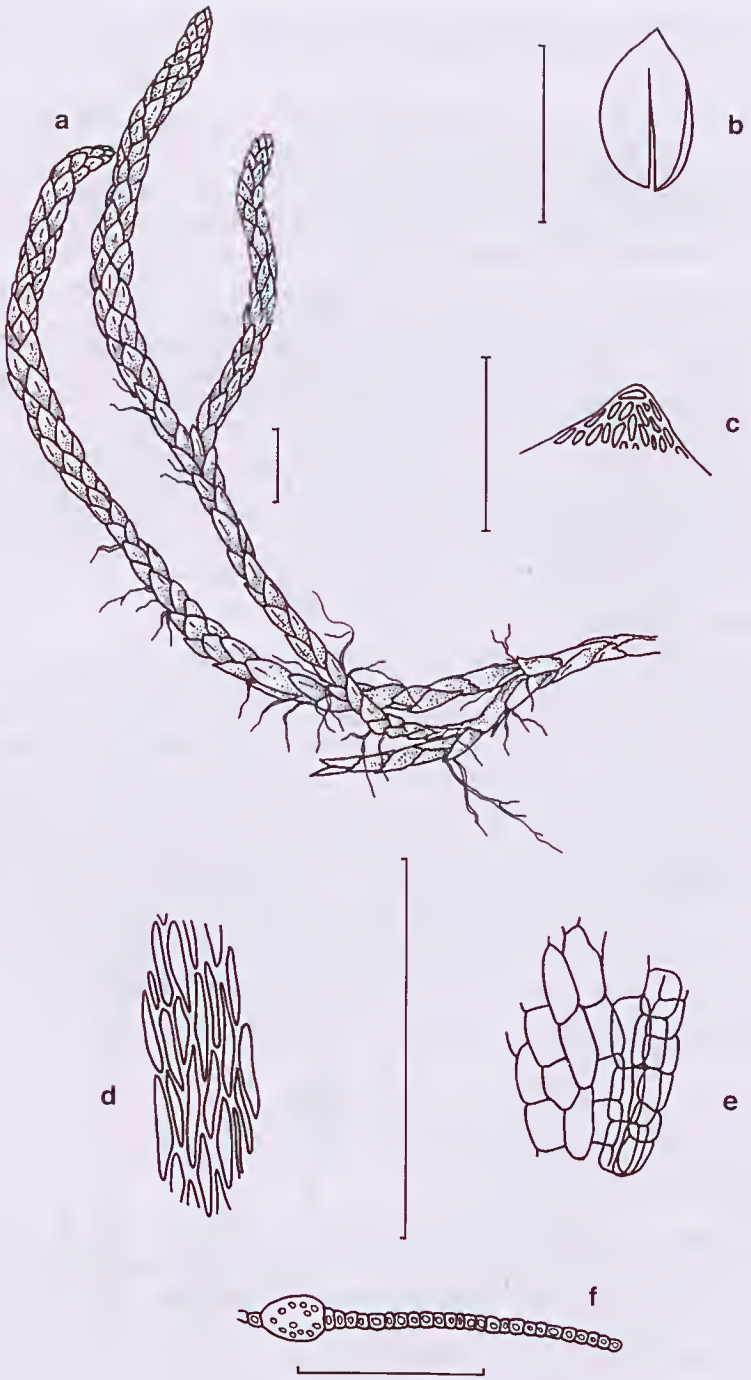

Fig. 2. *A. auratum* a, habit; b, leaf; c, leaf apical cells; d, mid-laminal cells; e, basal leaf cells; f, T.S. leaf. Scale Bars: a = 1.0 mm; b = 0.5 mm; c–f = 100 μm.

River, upstream from Millstream Falls on wet basalt with *Brynm argenteum (W.W. Watts Q532)*'. *Anomobryum auratum* in Australia consists of golden-brown dense turfs on wet soil and splashed rocks near water.

Distribution: north-eastern Queensland at moderately high elevations (900–1000 m). Fig. 6b.

Specimens: Queensland: upriver of Little Millstream Falls, near park boundary, *J.R. Spence 5129* (NSW); Wallaman Falls National Park, *I.G. Stone 8518 p.p.* and *I.G. Stone 8508* (MEL); Millstream, Ravenshoe *W.W. Watts Q532* (as *A. cymbifolium*) (NSW).

Notes: *Anomobryum auratum* is paleotropical in distribution, found in Africa, southeast Asia and the Phillipines, although not yet known from New Guinea. Australian collections are sterile.

Ochi (1970, 1992) did not record *Anomobryum* for Australia although *A. cymbifolium* (Lindb.) Broth. had been reported by Brotherus and Watts (1918) for North Queensland. The Australian specimens fall within the gametophytic variation and structure of the traditionally considered single paleotropical species, *A. auratum* (Mitt.) A. Jaeger to which it is referred here. Within *Anomobryum*, species often strongly differ in capsule characteristics, so the identification of our plants as *A. auratum* remains tentative until sporophytes are found. Although the plants are similar to named specimens from elsewhere, they are overall somewhat smaller.

3. Anomobryum harriottii (R. Br. bis.) Dixon, *New Zealand Institute Bull.* 3(4): 202 (1926).

Basionym: *Bryum harriotii* R. Br. bis., *Trans. New Zealand Inst.* 31: 45, 30 (1899).

Type: New Zealand, wet banks near Weka Pass, April, 1882, *R. Brown* s.n.; holo ?BM [H. Ochi, *New Zealand J. Bot.* 22: 179–182 (1984) rejects this as a type.]

Anomobryum densum Dixon, *Bull. Torrey Bot. Cl.* 42: 103 (1915).

Type: New Zealand: holo BM.

Illustrations: none known.

Plants small in dense bright green turfs. Stems to 0.5–2 cm in length, with numerous subperichaetial innovations. Leaves ovate to orbicular, 0.5–1 mm in length, concave, leaf apices obtuse, margins plane, unbordered; costae strong, nearly reaching apex to percurrent, in cross section lacking guide cells; upper and mid-laminal cells short and broad, 10–25 μm × 5–6 μm (2–4: 1), incrassate, thick-walled, cells at base short-rectangular. Gemmae not known. Australian specimens sterile. Seta 1–2 cm long; capsule horizontal to pendulous, ovate to pyriform, with a narrow neck; peristome double, exostome teeth 16, endostome segments reduced with short basal membrane, cilia absent or rudimentary. Spores 20–25 μm. (Description of sporophyte taken from Sainsbury 1955). No chromosome number available. (Fig. 3a–f).

Habitat: This species occurs in mountain climates, where it favours damp rocks or soil-filled crevices on outcrops.

Distribution: widespread in the mountains of New Zealand as well as similar habitats in the New Zealand and Australian subantarctic islands including Macquarie Island. In Australia, *A. harriottii* has only been collected from Tasmania. It forms small bright green turfs on wet rocks. All Australian collections made to date have been sterile. Because of its small size, however, it is easily overlooked, and may be more common in Tasmania than the single collection suggests. Fig. 6c.

Specimens: Tasmania: Mt Franklin, *A.V. Ratkowsky s.n.*, 7 Jan 1978 (HO).

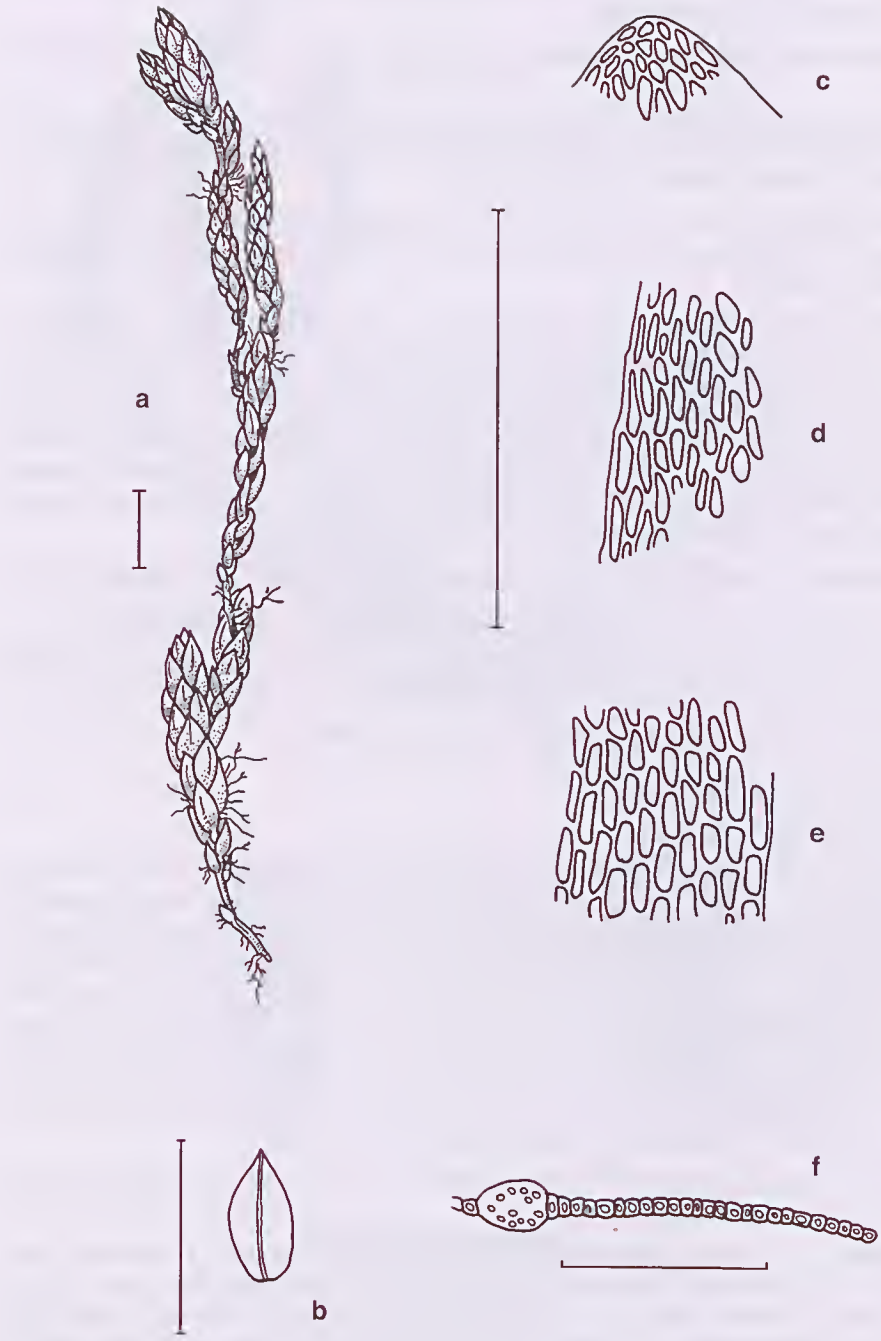

Fig. 3. *A. harriottii* **a,** habit; **b,** leaf; **c,** leaf apical cells; **d,** mid-laminal cells; **e,** basal leaf cells; **f,** T.S. leaf. (from *A.V. Ratkowsky s.n.*, 7 Jan 1978 (HO)). Scale Bars: a = 1.0 mm; b= 0.5 mm; c-f= 100 μm.

Notes: *Anomobryum harriotii* can be distinguished from *A. auratum* by a combination of the bright green colour and wide upper laminal cells. Where fertile specimens occur the peristome is reduced.

The placement of this species in *Anomobryum* is based primarily on its overall habit, i.e. very small slender julaceous stems with ovate, obtuse leaves and a weak costa. The upper laminal cells are shorter and broader than in most species of *Anomobryum*, which tend to have very elongate-vermicular cells. Ochi (1992) placed this and related species in a new section *Yasudae* of subgenus *Anomobryum* in the genus *Bryum*, characterized by broad upper laminal cells. We agree with Dixon that it is better placed in the genus *Anomobryum*.

4. Anomobryum lanatum *(P. Beauv.) J.R. Spence & H.P. Ramsay*, **comb. nov.**

Basionym: *Mnium lanatum* P. Beauv., *Prodr.* 75 (1805).

Type: Europe; holo ?GL.

Bryum argenteum Hedw. var. *lanatum* (P. Beauv.) Hampe, *Linnaea* 13: 44 (1839) and *Bryol. Eur.* 4: 148 (1839) (fasc. 6–9, Mon. 78).

Bryum bateae Müll. Hal. *Hedwigia* 37: 93 (1898).

Type: New South Wales: Mt Dromedary, Miss Bate 1883; holo MEL, iso NSW.

Bryum austroargenteum Broth. *Proc. Linn. Soc. New South Wales Suppl.* 30: 127 (1906), *nom. nud. in synon.*

Based on: Queensland: Brisbane (Milton), *H.Tryon s.n.*; MEL, BRI.

Bryum rotundum Hampe in W.W. Watts & T. Whitelegge *Proc. Linn. Soc. New South Wales Suppl* 30: 143 (1906), *nom. nud. syn. nov.*

Based on: Victoria: Ararat, *F.M. Campbell s.n.*; MEL, BRI.

Illustrations: (all as *Bryum argenteum* var. *lanatum*) Gangulee fig. 466, p. 971 (1974); Crum and Anderson fig. 265 (H–I), p. 671 (1981); Smith fig. 201 (4), p. 422 (1978).

Plants small in dense hoary silver-white tufts. Stems julaceous, 0.5–1.5 cm tall, branching by numerous perichaetial innovations. Leaves ovate-lanceolate, acuminate, 0.5–1.5 mm long, upper portion (½–¼), lamina hyaline, margins plane, mostly unbordered; costae strong, excurrent into a slender silver hairpoint, often weakly recurved when dry, in cross-section lacking guide cells and with a reduced stereid band; upper laminal cells 10 μm × 3 μm (3: 1), narrow; mid-laminal cells rhomboid-elongate, 25–30 μm × 6–8 μm (3–4: 1), firm-walled—incrassate, basal laminal cells predominantly quadrate, thin-walled. Gemmae as axillary leafy bulbils on sterile stems. Perichaetial leaves lanceolate, acuminate with long hairpoint. Seta 1.5–2.0 cm long; capsule short, < 2mm long, ovate with wide mouth, thick often wrinkled neck; peristome double, exostome teeth 16; endostome segments 16, basal membrane ½ or more height of exostome, cilia 1–3, appendiculate. Spores small, 8–15 μm. No chromosome number for Australian collections. (Fig. 4a–g).

Habitat: widespread on dry soil or rock, particularly in drier parts of Australia. Capsules rarely produced.

Distribution: cosmopolitan. Common in the subtropical and tropical areas of Indo-Malesia. In Australia (W.A., N.T., Qld, N.S.W., A.C.T.,Vic.). Fig. 6d.

Specimens: Western Australia: on dry exposed laterite bluffs along Fitzgerald River, near Quaalip Homestead, *J.R. Spence 4165*, Oct 1989 (NSW); Howig Hill, Esperance, *N.N. Donner 2860* (AD).

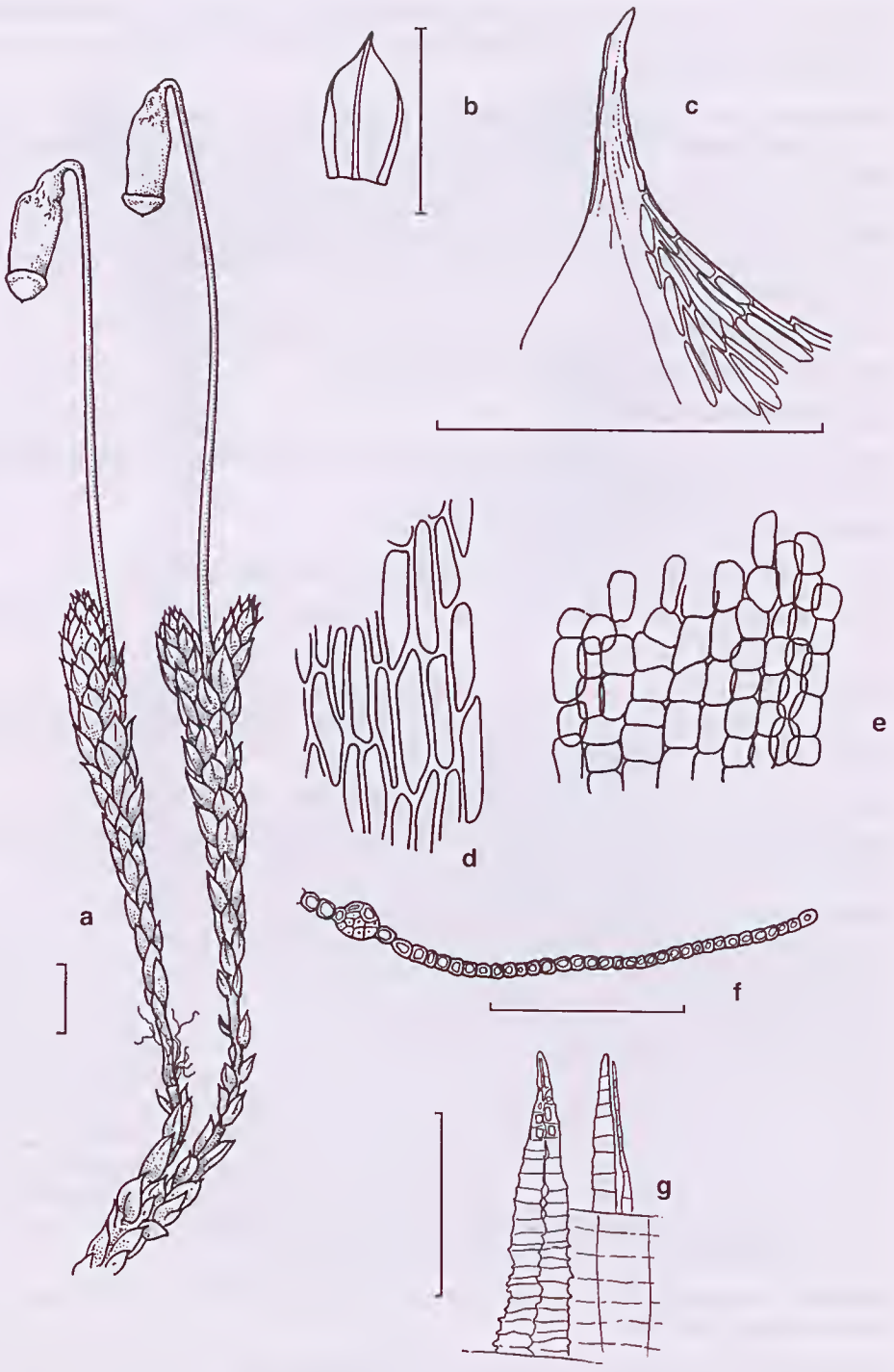

Fig. 4. *A. lanatum.* **a,** habits with sporophytes attached; **b,** leaf; **c,** leaf apical cells; **d,** mid-laminal cells; **e,** basal leaf cells; **f,** T.S. leaf; **g,** peristome. (a from *I.G. Stone 12145* (MELU); b–f from *W.B. Schofield 80214b* (NSW); g from *H.P. Ramsay R173* (NSW)). Scale bars : a = 1.0 mm; b = 0.5 mm; c–g =100μm.

Northern Territory: Mt Connor, *P.G. Martin s.n.*, 15 Jun 1953 (AD); Mt Olga, *P.G. Martin 1111*, Jun 1953 (AD); Mt Olga Gorge, *D.G. Catcheside 76.311* (AD); Mt Olga Gorge, *I.G. Stone 5140* (MEL); Simpson's Gap, *P.K. Latz s.n.*, 11 Sep 1974 (DNA); Ormiston Gorge, *J. Wauchope s.n.*, 6 Jan 1975 (DNA); Alice Springs, *P.K. Latz 6354* (DNA).

South Australia: Mt Lindsay, *I.G. Stone 287* (MELU); Tomkinson Ra., *N.N. Donner 6708* (AD); Wilpena Pound, *D.G. Catcheside 53.238* (AD); Adelaide, *D.G. Catcheside 53.145* (AD); 115 km south of Kingston, *I.G. Stone 5321* (MEL).

Queensland: Mt Bellenden Ker, *I.G. Stone 12145* (MEL); Brisbane, (Milton) *H. Tryon s.n.*, Aug 1890 (MEL, BRI); Herberton, *C.J. Wild s.n.* (BRI); Ingham, *H. Streimann 37152* (CANB); Mt Baldy, *H. Streimann 30652* (CANB); Windsor Tableland, *H. Streimann 29747* (CANB); Bunya Mts, *W.B. Schofield 90545* (NSW, UBC).

New South Wales: Mt Tinderry, East of Michelago, *H. Streimann 5215* (AD); Warrumbungles, *I.G. Stone 4117, 4127* (MEL).

Victoria: Melbourne, *R.A. Bastow s.n.* (MEL); Mt Buffalo, *D.G. Catcheside 74.11* (AD); Gorae West, *A.C. Beauglehole 1479* (MEL).

Notes: Although generally considered a variety of *B. argenteum*, this species is morphologically quite distinct among the silver species of *Anomobryum*. Unlike most other silver species, *A. lanatum* has a strong costa excurrent into a long white hairpoint. The presence of the hairpoint gives the species a hoary white look. Very rarely a few specimens occur that are intermediate between this species and *B. argenteum*, or occasionally display leaves of both types. However, where both species occur together the hoariness of *A. lanatum* makes it easy to separate. Although most authors, including Eddy (1996) who suggests that the separation is habitat-determined, refer to it as a variety of *B. argenteum* we prefer to recognise *A. lanatum* as a separate species until more detailed studies on silver species world-wide are completed.

5. Anomobryum subrotundifolium *(A. Jaeger) J.R. Spence & H.P. Ramsay*, **comb. nov.**

Basionym: *Argyrobryum subrotundum* Hampe, *Linnaea* 40: 312 (1876).

Type: Victoria: Mt Ararat, *Sullivan s.n.*, 1875; holo?; iso MEL, NSW ex MEL.

Bryum subrotundifolium A. Jaeger, *Ber. Tatig. St Gallischen Naturwiss. Ges.* 1877–78: 43 (1879).

Illustrations: Seppelt and Greene, figs 8, 9. pp 628–629 (1998).

Plants small, in dense silver-yellow turfs. Stems julaceous, fragile, 0.5–2.0 cm tall, sparsely branched by subperichaetial innovations. Leaves broadly ovate to broadly ovate-lanceolate, 0.5–1.5 mm long, apex obtuse or occasionally tapered somewhat abruptly to a short apiculus (<3 μm), upper portion (½–¼) of lamina hyaline, margins plane, mostly unbordered; costae weak, percurrent or not reaching apex, in cross-section lacking guide cells and with reduced stereid band; upper and mid-laminal cells rhomboid-hexagonal, >14 μm wide, mostly >16 μm long (2–3: 1), thin- or often firm-walled, basal laminal cells predominantly short-rectangular (2: 1), thin-walled. Capsules unknown. No chromosome number available. (Fig. 5a–f).

Habitat: mostly on dry rock or soil over rock in exposed sites, often at moderately high elevations.

Distribution: recorded for Australia (W.A., N.T., A.C.T., VIC, TAS) including Macquarie Is., also Antarctica (South Victoria Land). Fig. 6e.

Specimens: Western Australia: Boorara 10 km ESE of Kalgoorlie, *D. Kemsley s.n.* (MEL).

Northern Territory: George Gill Ra, Kings Canyon, *A.C. Beauglehole s.n.*, 2 Jul 1965 (MEL).

New South Wales: Cave Creek, Blue Waterholes, *J.R. Spence 4470 and H. Streimann* (NSW).

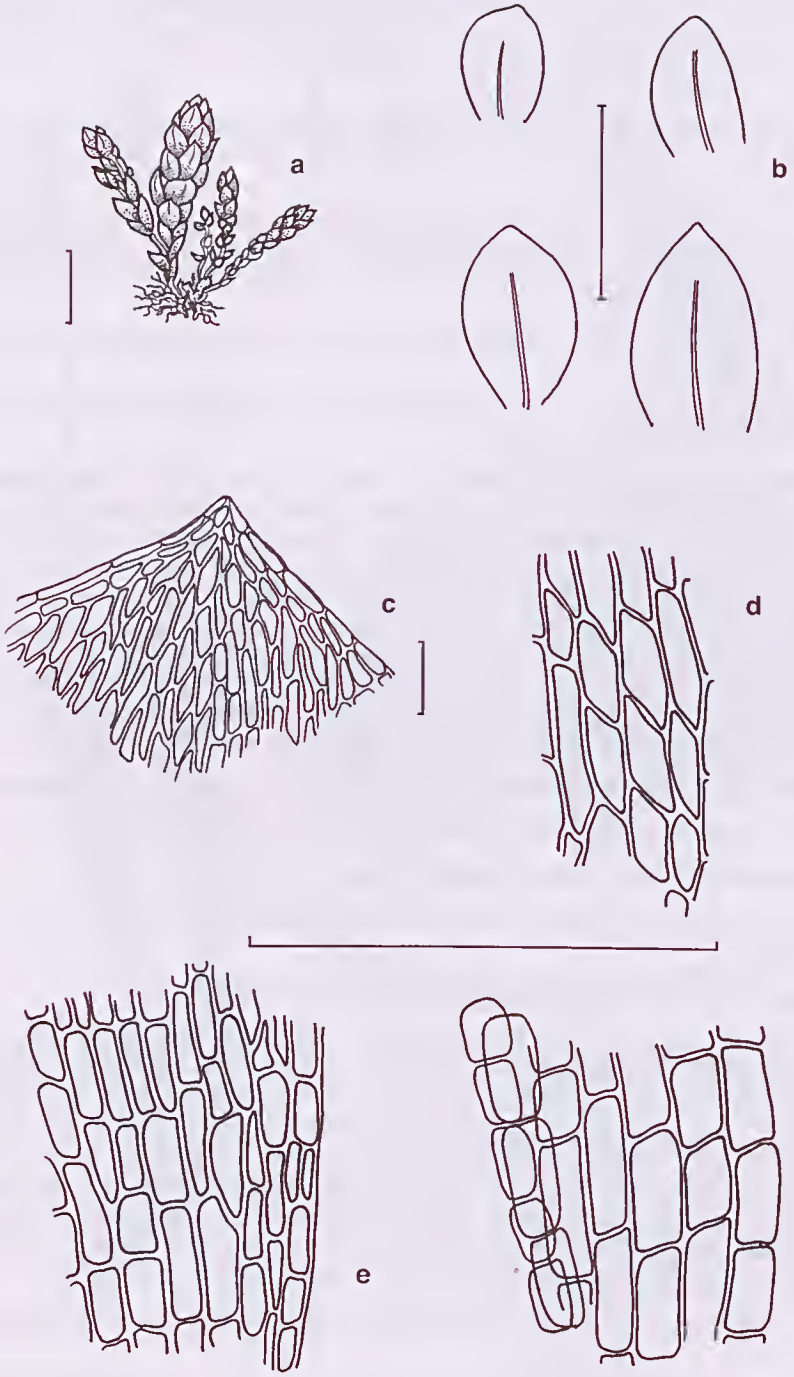

Fig. 5. *A. subrotundifolium*. **a,** habit; **b,** leaves; **c,** apical leaf cells; **d,** mid-laminal cells; **e, f,** basal leaf cells. (a from *Sullivan s.n.*, 31 Jul 1875 (isotype MEL); b (above), c, d, e from *Sullivan s.n.*, 31 Jul 1875 (isotype MEL); b (below), f from *J.R. Spence 4470* (NSW)). Scale Bars: a = 1.0 mm; b = 0.5 mm; c–f = 100 μm.

Victoria: Mt Ararat, *Sullivan s.n.*, 31 Jul 1875, (iso MEL): on roof, Parkville, Melbourne *I.G. Stone 11893* (MEL).

Tasmania: Mt Wellington, *D.A. and A.V. Ratkowsky B368* (MEL).

Notes: A poorly known and undercollected species, *A. subrotundifolium* is related to the silvery species *A. sp.* (= *Bryum argenteum*) and *A. lanatum*, but differs from both of these in the obtuse leaf apex, leaves often cucullate, wider laminal cells, absence of hairpoint or apiculus, and basal laminal cells that are rectangular not quadrate. Recent DNA and morphological studies (Selkirk pers. comm.) have indicated it is distinct from *A. sp.* (=*B. argenteum*). In South Victoria Land, Antarctic, populations formerly named as *Bryum argenteum*, have been referred to *Bryum subrotundifolium* (= *Anomobryum subrotundifolium*) (Seppelt & Greene 1998). Mention is also made of archegonial and antheridial plants although no sporophytes were found. No fertile material has been located in Australian populations.

Although listed in Watts and Whitelegge (1906) as *Bryum subrotundifolium* from 'Vic.: Mt Macedon Sullivan' and also 'Mt Macedon Mrs Martin' this species is not listed by Ochi (1970) nor by Scott and Stone (1976). It is listed, however, as an endemic species in Streimann and Curnow (1989). Four specimens from the Northern Territory designated as *B. argenteum* in Catcheside and Stone 1988 p. 15, have proved on further investigation, to be *A. subrotundifolium*. However, there are a number of other specimens of *A. sp.* (=*B. argenteum*) and *A. lanatum*, since studied, that occur in the N.T. particularly the Alice Springs area (see Fig. 6).

Excluded species

Anomobryum filescens Bartr. recorded from W.A. (1951) = *Eccremidium pulchellum* (Hook. f. & Wils.) C. Muell., vide Scott & Stone 1976: 124.

Discussion

Recent phylogenetic work using molecular, anatomical and morphological characters has indicated that the family Bryaceae is polyphyletic, with traditionally recognized genera being more closely related to members of other families, including the Mniaceae, Meesiaceae, and Rhizogoniaceae (Cox et al. 1999; Cox & Hedderson 1999; Pederson 2000). Their studies clearly indicate that re-alignments of genera and revised definitions of some alternate-diplolepidous moss families are needed, particularly for the Bryaceae. Cox and Hedderson (1999) suggest that traditional gametophytic characters, which in past classifications have not been given as much weight as sporophyte characters, may provide valuable insights into moss phylogeny (cf. Spence 1987).

As recognized in this study, *Anomobryum* consists of about 50–60 species of small mosses with julaceous habits, heterogeneous laminal areolation, a weak costa lacking guide cells, with capsules that vary from erect to pendulous with a bryoid peristome that is either perfect or variously reduced. Based on traditional morphological characters, the genus appears to be most closely related to various sections of *Bryum*, in particular those centered around the species *Bryum bicolor*, *B. alpinum*, and *B. subapiculatum*. Recent DNA sequencing studies of the family, place *Anomobryum* in a clade that largely corresponds to the traditional subfamily Bryoideae (Cox & Hedderson 1999; Cox et al. 1999). This subfamily has been variously interpreted (cf. Pedersen 2000) but includes such core genera as *Bryum* s.l., *Rhodobryum*, *Anomobryum*, *Plagiobryum*, *Brachymenium* and *Rosulabryum*. Only a few predominantly northern hemisphere species have been used in the molecular work to date, however, and much of the range of morphological diversity in the subfamily remains unsampled in the

molecular studies. In a more recent analysis, Pedersen (2000) used morphological and anotomical characters to examine relationships in the family. In his analyses *Anomobryum julaceum* is shown as being ancestral to a clade composed primarily of species of *Mielichhoferia, Schizymenium, Pohlia, Orthodontium* and *Brachymenium*. However, the cladograms have low stability, and Pedersen states that more work is required. More recently, he has re-analyzed his data with the addition of *Leptostomum* as an additional outgroup (Pedersen, pers. comm.). His most recent unpublished results place *Anomobryum julaceum* and *Bryum argenteum* in a clade with *B. bicolor, B. alpinum*, and *B. rubens* (which is closely related to *B. subapiculatum*). These results, as yet unpublished, are essentially identical to our understanding of the relationships of these species.

Additional phylogenetic work is now being carried out (Spence & Ramsay in prep.) using a larger group of species that includes more of the gametophytic diversity in the Bryoideae. Currently, a paper is in preparation presenting our views of the subfamily relationships using cladistics (Spence & Ramsay in prep.).

Fig. 6. Distribution maps for *Anomobryum* in Australia. a, *A. sp.* (=*Bryum argenteum*); b, *A. auratum*; c, *A. harriottii*; d, *A. lanatum*; e, *A. subrotundifolium*. *LHI* = Lord Howe Island.

Acknowledgments

Collections were examined from the following Australian herbaria: AD, BRI, CANB, DNA, HO, MEL (incorporating MELU), NSW, and PERTH. We thank the curators of these herbaria for their ready assistance. Particular thanks are due to Dr. Barbara Briggs at NSW for providing equipment and office space at the Royal Botanic Gardens, Sydney and Dr Elizabeth Brown for discussions. This project was partially funded by an Australian Biological Resources Study grant. John Spence is indebted to N. Pedersen for access to unpublished data. Illustrations were prepared by the combined efforts of H.P. Ramsay (leaves, cells, sections, peristomes, assembling of plate) and L. Elkan (habit studies and inking-in of plate).

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Potentilla and *Fragaria* (Rosaceae) reunited

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Abstract

Mabberley, D.J. (Nationaal Herbarium Nederland, University of Leiden, The Netherlands, and Royal Botanic Gardens Sydney, Mrs Macquaries Road, Sydney, NSW 2000, Australia) 2002. Potentilla *and* Fragaria *(Rosaceae) reunited.* Telopea *9(4): 793–801.* Because morphological, genetic and DNA evidence shows that *Fragaria* is nested in *Potentilla*, the former is referred (following Scopoli 1760) to the latter. Remarks on the value of broad generic concepts permitting infrageneric units to be recognized on non-morphological characters are presented. A formal description of the 'intergeneric' hybrid to which the cultivars 'Serenata' and 'Frel' are referred, **P. x rosea** Mabb., is provided. New combinations and a *nomen novum* in *Potentilla* (**P. x ananassa** (Rozier) Mabb. [the commercial strawberry], **P. chiloensis** (L.) Mabb. [one of its parents; **new lectotype**], **P. daltoniana** (J. Gay) Mabb., **P. iinumae** (Mak.) Mabb., **P. nilgerrensis** (J. Gay) Mabb. [**new lectotype**] **P. nubicola** (Hook.f.) Mabb. [**new lectotype**], **P. pentaphylla** (Losinsk.) Mabb., **P. silvanus** Mabb. [*Fragaria tibetica*] and **P. yakusimensis** (Masam.) Mabb. [*F. nipponica*]) are made in a list of species and commercially significant hybrid strawberries generally referred to *Fragaria*. Some authorities and places of publication of names in current use are also amended.

Introduction

> POTENTILLA ... the genus, already extended by the admission of *Tormentilla* and *Comarum*, would, perhaps, be still better defined if the *Strawberry* and *Sibbaldia* were likewise included. It would then comprise all *Rosaceae* with a double calyx, distinct 1-seeded carpels ... and the styles not transformed into long, feathery beaks or awns.
>
> George Bentham, *Handbook of the British Flora*, p. 192 (1858).

In preparation for corrected reprints of *The Plant-book* (Mabberley 1997a), it has been necessary to examine the nomenclature of a number of commercially important fruits, notably *Citrus* (Mabberley 1997b, 1998), *Annona* spp. (Mabberley 1999a), hybrid grapes (Mabberley 1999c), and apples (Mabberley et al. 2001).

In the last paper, it was shown that, if the genus *Malus* Mill. (Rosaceae) is maintained, the correct name for orchard apples is *M. pumila* Mill.: it was pointed out that if a broad view of *Pyrus* L. is taken, as it was in the early part of the last century, then the name would revert to Linnaeus's, *Pyrus malus*. It was also pointed out, following Walters (1962), that *Fragaria* (strawberries, Rosaceae) should be included in *Potentilla*. Similarly, *Amygdalus* L., *Armeniaca* Scop., *Cerasus* Mill., *Laurocerasus* Duham., *Padus* Mill. and *Persica* Mill. are back in *Prunus* L. (Rosaceae; Bortiri et al. 2001); *Lycopersicon* Mill. and *Cyphomandra* Sendtner are now in *Solanum* (Solanaceae; Spooner et al. 1993, Bohs 1995); *Lychnis* L. falls into *Silene* L. *s.l.* (Caryophyllaceae; Mabberley 1999b; unless that be shattered and unfamiliar segregates be recognized [Lidén et al. 2000]); *Acidanthera* Hochst., *Anomalesia* N.E. Br. and *Homoglossum* Salisb. (*Petamenes* Salisb. ex J.W. Loudon) are in *Gladiolus* L. (Iridaceae; Goldblatt & Manning 2000: 125); *Cheiranthus* L. is in *Erysimum* L. (Cruciferae) while *Diplycosia* Bl., besides *Pernettya* Gaud., is in *Gaultheria* Kalm ex L. (Powell & Kron 2001), *Ledum* L. and probably other genera are in *Rhododendron* L., and *Philippia* Klotzsch and many other splits (Goldblatt

& Manning 2000: 423) are included in *Erica* L. (Ericaceae); *Heliocereus* (A. Berger) Britton and Rose and *Nopalxochia* Britton and Rose are in *Disocactus* Lindl., while *Lobivia* Britton and Rose is in *Echinopsis* Zucc. (Cactaceae); *Stephanotis* Thouars is in *Marsdenia* R. Br. (Apocynaceae s.l.) — see Mabberley (1997) for details; *Fortunella* Swingle and *Poncirus* Raf. are back in *Citrus* L. (Rutaceae; Mabberley 1998, Mabberley 2002); *Mahonia* Nutt. is back in *Berberis* L. (Berberidaceae; Whittemore 1997); *Sansevieria* Thunb. falls into *Dracaena* L. (Convallariaceae; Bos 1998), and *Chrysalidocarpus* H. Wendl. into *Dypsis* Mart. (Palmae; Dransfield & Beentje 1995: 123). With such changes, it is now possible to recognize monophyletic rather than paraphyletic genera in all of these groups: such 'intergeneric' hybrids as x *Citrofortunella* J. Ingram and H. Moore and x *Citroncirus* J. Ingram and H. Moore (Rutaceae), x *Gaulnettya* Marchant (Ericaceae), x *Heliochia* G. Rowley (Cactaceae) and x *Mahoberberis* C. Schneider (Berberidaceae) consequently disappear.

There can be no doubt that further molecular work in remodelling the relationships of plant taxa, will, in many cases, restore the broad view of genera: it may well be that horticulturists' reticence in retaining this broad view, in say, *Amaryllis* L. (including *Hippeastrum* Herb., Amaryllidaceae), *Hibiscus* L. (including *Abelmoschus* Medik., *Malvaviscus* Fabr., Malvaceae) and *Veronica* L. (including *Hebe* Juss., Scrophulariaceae/Veronicaceae) will be vindicated.

The *Fragaria* problem

For a historical account of the fate of genera ascribed to the *Potentilla* group, see Erikkson et al. (1998), who review the differing elaboration of the torus into a fleshy receptacle bearing achenes, typical of strawberries, but a condition probably arrived at more than once in the group. The important genera to be considered in this study include several that Linnaeus recognized as distinct, but are now generally incorporated in *Potentilla* L., a genus of some 500 species (Mabberley 1997a: 581). Within *Fragaria*, a genus of perhaps 12–15 species and the only one which is widely kept distinct now, Linnaeus described *F. sterilis* L., named for its not having a fleshy receptacle and thus being inedible. Even for him then, the fleshy nature of the 'strawberry fruit' was less important than other features. Smith (1800: 547) pointed out that *F. sterilis* is intermediate between the Linnaean genera *Fragaria* and *Comarum* and, shortly afterwards, Persoon (1806–7) transferred it to *Potentilla*, giving it the illegitimate name *P. fragariastrum* Ehrh. ex Pers., since corrected to *P. sterilis* (L.) Garcke[1]. It lacks the typical 'strawberry', although its overall facies is superficially very similar to *F. vesca* L., such that the 'generic' distinction has confused professional and amateur alike ever since.

Of the genera Linnaeus kept distinct from *Potentilla*, Scopoli (1760: 572) subsumed *Tormentilla* L., *Comarum* and *Fragaria* in *Potentilla*. The bulk of the remaining genus, *Sibbaldia* L., which is concentrated in the Himalaya, was later included in *Potentilla* by Joseph Hooker (thereby following Bentham's suggestion — see above) in his *Flora of British India* (2: 345, 1878). The collecting of certain wild plants believed to be hybrids between *Sibbaldia procumbens* L. (i.e. *P. sibbaldii* Hall.f.) and *Fragaria virginiana* Mill. (Staudt 1999: 100) supports the inclusion of *Sibbaldia* in *Potentilla*.

[1] These *Potentilla* names are incorrectly cited in *Index Kewensis*, IPNI etc. and were published as follows: **Potentilla fragariastrum** Ehrh. ex Pers., Syn. 2: 56 (1806), nom. illeg., nom. superfl. pro *F. sterilis* L., i.e. **Potentilla sterilis** (L.) Garcke, Fl. Halle 2: 200 (1856).

Most striking perhaps in the current context, though long since 'sunk', is *Comarum*, which has a somewhat swollen receptacle intermediate between that of a typical *Fragaria* and *Potentilla*: the type, now *P. palustris* (L.) Scop., is one of the parents of the recently selected cultivars 'Frel' (US Patent in 1989) and 'Serenata' (US Patent in 1991). Ellis (1962) was the first to report crosses made between the hexaploid *Potentilla palustris*, of Eurasia and North America, and the octoploid garden strawberry, *Fragaria* x *ananassa* Duch. ex Rozier (as *F. grandiflora*), a cross between two American species. He recorded that the hybrids were heptaploid and had pink petals intermediate between the purple ones of *P. palustris* and the white ones of the strawberry.

Since that time, back crosses with strawberries have been made and released into commerce under the names 'Frel' and 'Serenata' (which is a further back cross, between 'Frel' **Pink Panda**™ and a strawberry). Because of the repeated backcrossing with strawberries in its ancestry, 'Frel' is regarded as a strawberry for patent purposes and is referred to as a *Fragaria* cultivar (Leslie 1995). From a botanical standpoint it is one of the *Potentilla-Fragaria* hybrid complex and it should be afforded an intergeneric name if the genera *Potentilla* and *Fragaria* are to be kept separate (Mabberley 1997: 287).

Potentilla has sometimes been shorn of some subgroupings, notably the shrubby *Dasiphora* Raf. ('*Pentaphylloides* Duham.', Duhamel's true *Pentaphylloides* being a synonym of *Potentilla* s.s. (Erikkson et al. 1998)), but molecular work has shown that *Potentilla* as presently understood is paraphyletic if *Dasiphora*, *Fragaria*, and those *Fragaria* species sometimes referred to *Duchesnea* Sm., are excluded from it. Now *Duchesnea*, species of which have a swollen torus but insipid 'fruits', has been formally moved to *Potentilla* (Kalkman 1968, following Wolf [1908]), and *Dasiphora* is almost never used. Hybrid seedlings have been raised between the type species of *Potentilla*, *P. reptans* L., and the commercial strawberry (Ellis 1962).

As conclusions based on morphological characters have been resoundingly confirmed by both molecular and breeding studies, either the rest of *Fragaria* is brought in or the genus *Potentilla* must be fragmented (Erikkson et al. 1998) into narrowly defined genera with unfamiliar names. At this stage monophyletic units in *Potentilla s. l.* are not clear and I therefore concur with Craven (2001), when dealing with large genera such as this. In discussing *Syzygium* L. (Myrtaceae), he writes, 'It is undesirable to optimistically propose new genera based on flimsy differences and hypocrisy to continue using definite invalid ones'.

Continuing to use *Potentilla* in the broad sense will provide continuity of names for almost all of the species so far described, though other genera may also be drawn in (Erikkson et al. 1998). Should infrageneric groupings be recognized later, they can be given infrageneric names (cf. Davis & Heywood 1963: 106, Mabberley 1997: xii). In so doing, such clades can, if necessary, be defined by molecular parameters, thereby obviating the need for botanists having to strive to find ever more obscure 'morphological features', which are ever more unusable for the layman trying to identify 'taxa' given names associated with ranks. There is, after all, no theoretical reason to suppose that all clades will be recognisable by eye, for evolution may act on chemical constitution, disease resistance etc., which can be more important as 'characters' to ecological forces or creatures such as fungi acting on plants.

Nomenclature

Although the genera *Fragaria* and *Potentilla* have been combined since at least the time of Scopoli (1760), the fact that the receptacle of strawberries is edible, while that of *Potentilla* s.s. is not — a prime example of 'folk taxonomy' (Walters 1962), has encouraged their being kept separate right up until today. Despite the fact that,

following Bentham, both Ellis (1962) and Kalkman (1968) argued the case for amalgamation, they did not take the step they advocated (see also van der Meijden 1996: 235), the sole argument for not so doing being the nomenclatural one. However, long ago, Prantl (1884), and Krause (1904: 102) followed Scopoli (1771: 363, who was the first to make a new combination in *Potentilla* for a *Fragaria*), and transferred other *Fragaria* names to *Potentilla*, so that there are names in *Potentilla* available for use for some of the strawberries (see below), as well as most species of *Sibbaldia* and *Duchesnea*.

The reason for modern authors' reticence (see e.g. Erikkson et al. 1998) has in large part been because it was thought that *Potentilla* had been first included in *Fragaria* (Crantz 1763: 9; 1766: 176), so that it was believed necessary under the present Code to transfer several hundred other *Potentilla* names to *Fragaria*. This was clearly nonsensical and not in the interests of nomenclatural stability, but a successful proposal for the conservation of *Potentilla* over *Fragaria* would have removed this threat.

Fortunately, study of the work of Scopoli shows that it is unnecessary to do even that, because Scopoli (1760: 572) wrote under his entry for the genus *Potentilla*, 'Non opus est itaque ex *Potentilla*, *Tormentilla*, *Comaro* and *Fragaria*, totidem diversa genera constituere, contra Naturam'. Amongst his listing, which does not use Linnaeus's shorthand binomial system but quotes verbatim Linnaeus's phrase-names from *Species Plantarum*, he includes what is now called *Fragaria vesca* L., the type of *Fragaria*, and *Potentilla reptans* L., the type of *Potentilla*.

The consequence of this is that all that is now required is the transfer of the few remaining strawberry names, including the hybrid cultivars 'Frel' and 'Serenata', to *Potentilla*. Although the name-changes, like all name-changes, may be regretted, it is unlikely that the industry, which, unlike in its marketing of ornamentals, rarely uses the Latin names for strawberries in any case, will object strongly. Naturally those resisting the flow of rising scientific opinion (see Sanders & Judd 2000) by wishing to maintain *Fragaria* in its current circumscription as a separate genus, thereby recognising a paraphyletic *Potentilla*, can continue to use the names published in *Fragaria*. Even so, for them the names of the hybrids from which 'Frel' and 'Serenata' were bred are still a problem from a botanical standpoint without an 'intergeneric' name. Moreover, even if *Fragaria* is maintained, there are some clarifications of typifications needed.

The species and hybrid names needed for a new edition of *The Plant-book* (Mabberley 1997) and those other names widely used in modern Floras and the trade or plant-breeding (see Staudt 1962, 1989, 1999, Staudt & Dickoré 2001) for distribution etc. of species for which new names are not proposed here and/or are not grown in Australia) are therefore as follows (an asterisk indicates amendments or additions to *Index Kewensis*, IPNI etc.):

1. **Fragaria* x *ananassa* [Duch. ex] Rozier, Cours Comp. Agric. 5: 52, t. 5, fig. 1 (1785), i.e. *P. virginiana* (Mill.) E.H.L. Krause x *P. chiloensis* (L.) Mabb., = **Potentilla x ananassa** *(Rozier) Mabb.*, **comb. nov.**

Type: Cultivated in France, *A.N. Duchesne* '9' [Herb. Linn. 654.19], 'le fraisier-ananas. Fragaria ananassa' scrips. *Duchesne* (LINN, fiche), lecto selected by Staudt (1962: 884).

As pointed out by Navarro and Muñoz Garmendia (1998), Duchesne's binomial was first validated by Rozier. Rozier's herbarium was at the Lyon Palais des Arts, France, but, after investigation, Professor Ph. Morat (P) wrote (pers. comm.), 'Depuis [1900] les archives ont été distribuées en deux parties: l'une a été dirigée vers la Bibliothèque municipale, l'autre vers la Bibliothèque de l'Académie des Sciences, Belles Lettres et Arts de cette même ville. Dans les deux endroits les recherches ont été infructueuses.' Until the herbarium is found and examined, the published plate could perhaps serve

as lectotype, but, as Rozier (l.c.) wrote, 'Nous suivrons l'order qu'il [Duchesne] a établi', there is perhaps sufficient link to Duchesne's work and collection, thereby supporting Staudt's typification *pro tem*.

Notes: This is the octoploid garden strawberry (*P. chiloensis* x *P. virginiana*) as cultivated in Australia and all over the temperate world for the fruit trade. Some 2.5 million tonnes were traded in 1999 (Hancock 1999: 1). The most important cultivars grown in Australia are those bred in California, and, of those, 'Camarosa' is the world's most widely planted (Hancock 1999: 13). *Potentilla* x *ananassa* is one of the parents of *P.* x *rosea*, the other being *P. palustris*.

2. *Fragaria chiloensis* (L.) Mill., Gard. Dict. Edn 8, Fragaria no. 4 (1768) = **Potentilla chiloensis** *(L.) Mabb.*, **comb. nov.**

Basionym: *Fragaria vesca* L. var. *chiloensis* L., Sp. Pl.: 495 (1753).

Type [icon, reproduced here]: Dillenius, Hort. Elth. t. 120, f. 146 (1732), **lecto, selected here.**

There is no original herbarium material in the Linnaean herbaria, the specimen LINN 654.21 selected by Staudt (1962: 881; 1999: 100) being a post-1753 addition to Linnaeus's own herbarium (Charlie Jarvis, pers. comm.), so the only element Linnaeus cited, Dillenius's plate, is here chosen as lectotype. Typotype material (most probably examined by Linnaeus during his visit to Oxford in 1736 — see Clokie 1964: 201) is in Herb. Dillenius (OXF [photo seen]); a sheet (1053/2) in Herb. Sherard (OXF) is possibly a duplicate (Serena Marner, pers. comm.).

Notes: west coasts of North and South America; one of the octoploid parents of *P.* x *ananassa*. Cultivated in Australia.

3. *Fragaria daltoniana* J. Gay in Ann. Sci. Nat. IV, 8: 204 (1857) = **Potentilla daltoniana** *(J. Gay) Mabb.*, **comb. nov.**

Type: Sikkim, '10–12000 ped.', *J. D. Hooker s.n.* in herb. J.D. Hooker and T. Thomson (K, holo; K, iso; OXF, iso [photocopy seen]; P, iso).

Notes: Himalaya, N Burma. Diploid.

4. *Fragaria* 'Frel' and 'Serenata' = cultivars of **Potentilla x rosea** *Mabb.*, **hybr. nova** (*Potentilla palustris* (L.) Scop. x *P.* x *ananassa* (Rozier) Mabb.)

Hybrida hortensis, heptaploidea, e *P. palustre* (L.) Scop. et *P. x ananassa* (Rozier) Mabb. exorta, inter parentes media, insigniter corolla rosea.

Type [icon]: Proc. Linn. Soc. London 173, t. 2, excl. fig. 5 (1962).

Notes: Jack R. Ellis first synthesized such heptaploid hybrids at University College London and, using colchicine, produced 14-ploid plants (2n = 98) with enhanced fertility (Ellis 1962). Since that time he has raised back-crosses with *P.* x *ananassa* to give the named cultivars (see above) with much lower chromosome numbers.

The named cultivars are therefore *P.* x *rosea* Mabb. 'Frel' and its offspring 'Serenata' (2n = 58). No material of the original cross was preserved (Jack Ellis, pers. comm.), so the photographs of it are **here designated** the type.

'Frel' (as **Pink Panda™**) is grown in Australia.

5. *Fragaria indica* Jacks. (*Duchesnea indica* (Jacks.) Focke) = ***Potentilla indica*** (Jacks.) T. Wolf

6. *Fragaria iinumae* Mak. in Bot. Mag. Tokyo 21: 156 (1907) = **Potentilla iinumae** (*Mak.*) *Mabb.*, **comb. nov.** (syn. *P. daisenensis* Honda)

Type: Makino cites only the illustration (t. 28) in Y. Iinuma's *Sintei Sōmoku-Dzusetsu* 9 (1874), but the description is clearly drawn up from other material not cited (?TI, n.v.). At UC is a sheet labelled 'Makino Herbarium 367 89', Japan, Yamagata Pref., Akumi-gun, Mt. Chokai, 1928, *T. Makino s.n.*, for example.

Notes: Japan, Sakhalin. Diploid.

7. **Fragaria moschata* Weston, Bot. Univ. 2: 327 (1771) = ***Potentilla moschata*** (Weston) Prantl

Notes: Europe. Hexaploid. Cultivated in Australia.

8. *Fragaria moupinensis* (Franchet) Cardot = ***Potentilla moupinensis*** Franchet

9. *Fragaria nilgerrensis* [Schldl. ex] J. Gay in Ann. Sci. Nat. IV, 8: 206 (1857) = **Potentilla nilgerrensis** *(J. Gay) Mabb.*, **comb. nov.**

Type: India, Nilgiri Mts, *J.D. Hooker and T. Thomson s.n.* (K, lecto, **selected here**; OXF, isolecto [photocopy seen]; P, isolecto).

Staudt (Bot. Jahrb. 121: 299 [1999]) has selected a Metz sheet from Robert Wight's herbarium (now at K) as 'lectotype', with a P sheet as 'isolectotype' ('isolecto' — L). Although Gay took the name from Schlechtendal's unpublished one on a Metz sheet (*F. Metz s.n.* in Hohenacker, Pl. Ind. Or. Exsicc. n. 1578), his description is based on the Hooker and Thomson sheet.

Notes: Nilgiris (SW India), Khasia Mts (NE India), Sikkim to China. Diploid.

10. *Fragaria nipponica* Mak. in Bot. Mag. Tokyo 25: '(229)' (1911, *japonice*) and 26: 282 (1912, *anglice*), non *Potentilla niponica* T. Wolf [sic], = **Potentilla yakusimensis** *(Masam.) Mabb.*, **comb. nov.**

Basionym: *Fragaria yakusimensis* Masam. in J. Soc. Trop. Agric. Taiwan 3: 115 (1931).

Type: Japan, Yaku Is., Ōsumi Province, June 1928, *G. Masamune s.n.*. (TAI, not found, so perhaps transferred to a Japanese herbarium (Chen-Meng Kuo (TAI), pers. comm.), TI? — not found, T. Kajita (TI), pers. comm.).

Notes: Japan, Korea. Diploid.

11. *Fragaria nubicola* (Hook.f.) [Lindl. ex] Lacaita = **Potentilla nubicola** *(Hook.f.) Mabb.*, **comb. nov.**

Basionym: *Fragaria vesca* L. var. *nubicola* Hook.f., Fl. Brit. India 2: 344 (1878).

Type: Tibet (Xixang), Gosainthan [28°22'N, 85°50'E], 'Potentilla sp.', *Anon* [? *Bharat Singh*] in East India Company 1238/1 (K, **lecto selected here**; K-W, isolecto).

Notes: Bokhara to Sikkim. Diploid.

12. *Fragaria pentaphylla* Losinsk. in Izv. Glavn. Bot. Sada SSSR 25: 69 and t. 4 (1926), = **Potentilla pentaphylla** *(Losinsk.) Mabb.*, **comb. nov.**

Type: China, Kansu, Li-dscha-pu, 20 June 1885, *G.N. Potanin s.n.* (LE, lecto [selected by Stepanova in Staudt & Dickoré 2001: 344], n.v.; US, isolecto, photocopy seen). Note that *Potentilla pentaphylla* Richter ex Pohl (1814, i.e. *P. recta* L.) was a name only ever published in synonymy.

Notes: southwest China. Diploid.

13. *Fragaria tibetica* Staudt and Dickoré in Bot. Jahrb. Syst. 123: 349 (2001), non *Potentilla thibetica* Cardot (1916), = **Potentilla silvanus** *Mabb.*, **nom. nov.**

Type: [Cult.,] Germany, Merzhausen near Freiburg [ex Tibet (Xixang), Everest (Qomolangma) E, Kama Chu, W of Sakyetang, 10 Oct 1989, *W.B. Dickoré s.n.*], s.d., *W.B. Dickoré s.n.* (B, holo, digital image seen). The new specific name commemorates the Nestor of strawberry systematics, Prof. dr. Günther Staudt, monographer of *Fragaria*. According to Hanks and Hodges (1988: 510), the surname Staudt is a variant of Staude, a name for someone living by a patch of uncleared dense undergrowth, a name cognate with the Old High German word *stūda*, a thicket or wilderness. The Roman God associated with such uncultivated land is Silvanus (Rose 1970), hence the epithet, which is a substantive; coincidentally, and happily, the habitat for this strawberry is said to include upper montane scrub (Staudt & Dickoré 2001), beyond areas of cultivation.

Notes: southwest China. Tetraploid, allegedly derived from *P. pentaphylla* (Staudt & Dickoré 2001).

14. *Fragaria vesca* L. = ***Potentilla vesca*** (L.) Scop.

Notes: Cultivars of this are the 'alpine' strawberries of patisserie. Diploid. Cultivated in Australia (material apparently brought with the First Fleet, 1788), this North Temperate species is naturalized in New Zealand.

15. *Fragaria virginiana* Mill. = ***Potentilla virginiana*** (Mill.) E.H.L. Krause, Sturm's Fl. Deutschland 8: 111 (1904) and Zweites Register [8]: 1 (1909?).

Note that although the meaning in the main text is clear, the basionym is cited only in the second index to the whole work.

Notes: This is an octoploid parent of *P.* x *ananassa*.

16. **Fragaria viridis* Weston, Bot. Univ. 2: 327 (1771) = ***Potentilla viridis*** (Weston) Prantl (April 1884; nec **Potentilla viridis* (Koch) Zimmeter in Jahres-Ber. Staats-Ober-Realschule Steyer 14: 6 [Aug.–Sept. 1884], i.e. *P. anserina* L., non **Potentilla viridis* (Neilr.) Fritsch, Excursionsfl. Oesterreich: 295 [1897], i.e. *P. pusilla* Host)

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Teucrium micranthum (Labiatae), a new species from Queensland, Australia

Barry J. Conn

Abstract

Conn, Barry J. (Royal Botanic Gardens, Mrs Macquaries Road, Sydney NSW 2000, Australia) 2002. Teucrium micranthum *(Labiatae), a new species from Queensland, Australia.* Telopea *9(4): 803–807.* **Teucrium micranthum** from Queensland, an erect subshrub, moderately to densely covered in multi-branched hairs and with ± persistent ovate, petiolate prophylls, is described as new. A key is provided to the three species of *Teucrium* in Queensland that have non-podiate flowers.

Introduction

In 1988, D. Fell first collected a fruiting specimen of an unknown labiate from Broken River in central Queensland. Unfortunately, it was not possible to confirm the generic placement of this collection, even though it appeared to be an undescribed species of *Teucrium*. Subsequent additional fruiting collections by other field workers (for details, refer 'Other specimens examined' below) have been made since that time and the taxon as been informally referred to as '*Teucrium* sp. (Ka Ka Mundi NP A.R.Bean 2170)' (Forster 2002). The author collected the first flowering specimens of this taxon from the Carnarvon National Park of Queensland. These collections confirmed that the taxon was an undescribed species of this genus. With the description of this new species, there are now eight named species of *Teucrium* occurring in Queensland and an additional species to be formally described, namely, '*Teucrium* sp. (Ormeau G. Leiper AQ476858)'. The latter species is a small shrub to about 0.5 m high, with ovate to slightly oblong lobed leaves to about 10 mm long and shortly podiate flowers.

Terminology follows Conn (1984), except for modifications to inflorescence terminology and the definition of podium (Conn 1995).

Teucrium micranthum *B.J. Conn*, **sp. nov.**

T. argutum R.Br. indumento ramosissimo prophyllis petiolatis ovatis differt.

Type: Queensland: Leichhardt District: Carnarvon National Park (Ka Ka Mundi Section), Tom's Tank, 3.4 km E of Park Boundary (24°47'S, 147°25'E), *B.J. Conn 4146, E.A. Brown & N.A. Leist*, 25 May 1999 (holo NSW 428108; iso BRI).

[*Teucrium* sp. (Ka Ka Mundi NP A.R.Bean 2170) (Forster 2002)]

Erect subshrub 0.1–0.3(–1) m high, producing erect branches from a thick woody stem and rootstock. *Branches* ± quadrangular, slightly ridged on angles to many-ridged and channelled (especially on older branches), moderately to densely hairy; hairs multi-branched (shortly stalked), ± patent, 0.1–0.2 mm long, white; moderately to densely glandular (especially in channels); glands hemispherical, sessile. *Leaves* aromatic, shortly petiolate; petiole to 1 mm long; *lamina* ovate to almost elliptic, light to mid-green, 4–7 mm long, 3–7 mm wide, with length 1–1.7 times width, distance from base of maximum width 0.3–0.5 times total lamina length; abaxial and adaxial surfaces moderately to densely glandular (glands as for branches), moderately to densely hairy

(hairs as for branches), margin entire, ± strongly recurved; apex obtuse to almost rounded, appearing narrower because margin often strongly recurved; venation mostly indistinct due to indumentum cover, midvein slightly raised on abaxial surface. *Inflorescence* a frondose racemiform conflorescence, 4–20-flowered, appearing as single flowers in axils; uniflorescence monadic. *Podium* minute, to 0.5 mm long, densely hairy (as for branches). *Prophylls* ± persistent, inserted distally near base of calyx (propodium c. 0.4 mm long; anthopodium c. 0.1 mm long, with propodium c. 4 times length of anthopodium), opposite, shortly petiolate (petiole c. 0.3 mm long); lamina ovate, 1–1.5 mm long, 0.6–0.8 mm wide, flattened, densely hairy (as for branches). *Calyx* green, campanulate; outer surface densely hairy (as for branches), midveins not prominent; *tube* c. 1 mm long, inner surface glabrous; *lobes* equal, triangular, c. 1 mm long, c. 0.8 mm wide at base, with length c. 1.3 times width, inner surface densely hairy (as for branches), apex subacute and minutely apiculate. *Corolla* 2.5–3 mm long, white; outer surface of lobes sparsely hairy (hairs as for branches, except some simple hairs also present), moderately glandular; inner surface moderately hairy in tube, hairs simple, spreading, c. 0.1 mm long; *tube* 1.3–1.5 mm long; *abaxial median lobe* ovate to slightly elliptic, c. 1.5 mm long, c. 1.2 mm wide, with length c. 1.3 times width, apex rounded; *lateral lobes* and *adaxial median lobe-pair* ± oblong, 1–1.3 mm long, 1.4–1.8 mm long, with length c. 0.7 times width (each lobe 0.7–0.9 mm wide, with length 1.4–1.6 times width), apex obtuse. *Stamens* inserted c. 0.4 mm above base of corolla; filaments to 1–1.5 mm long, sparsely hairy near base (as for inner surface of corolla tube); anthers 0.4–0.6 mm long, 0.5–0.7 mm wide. *Pistil* 3–3.5 mm long, strongly curved (towards abaxial plane); *ovary* cylindrical obovoid, 0.5–0.8 mm long, diameter 0.7–0.8 mm, lobes c. 0.1 mm long, glabrous, white distally; *style* 2–2.5 mm long; *stigma lobes* 0.8–1 mm long, soon becoming ± strongly deflexed. *Fruiting propodium* extended to c. 1.5 mm long. *Fruiting calyx* enlarged, yellow-green, maturing to dark brown, 3–3.5 mm long, densely glandular distally. *Mature mericarps* c. 2 mm long, with radial surfaces and basal half of tangential surface light brown and smooth, distal half of tangential surface and apex thickened and whitish to very pale fawn-coloured. (Fig. 1).

Other specimen examined: Queensland: North Kennedy District: Broken River, 1 km SW of Jack Hills Gorge, Wandovale Holding (19°30'S, 144°45'E), *D.G. Fell 850*, 13 Apr 1988 (NSW); Broken River (19°25'57"S, 144°48'25"E), *R.J. Fensham 1036*, 16 Jun 1993 (BRI). Leichhardt District: Duaringa Palmgrove Fauna Reserve [now Palmgrove National Park (Scientific) Duaringa] (24°55'S, 149°25'E), *S. Barry PG25*, 6 Jun 1989 (BRI); Carnarvon National Park (Ka Ka Mundi Section), north-eastern corner of Ka Ka Mundi National Park (24°42' 30"S, 147°38'30"E), *A.R. Bean 2170*, 1 Sep 1999 (BRI); Tom's Tank, 3.4 km E of Park Boundary (24°47'28"S, 147°25'56"E): *A.R. Bean 14867*, 8 May 1999 (BRI); *B.J. Conn 4144, 4145, 4147, E.A. Brown & N.A. Leist*, 25 May 1999, (BRI, NSW); Mantuan Downs, fenceline south of Police Creek, 10 km WNW of Mantuan Downs Homestead (24°23'25"S, 147°08'58"E), *D. Butler s.n.*, 26 Jun 1999 (BRI AQ490658).

Distribution: this species is known from the North Kennedy and Leichhardt Botanical Districts, Queensland. (Fig. 2).

Habitat: this species occurs in tall woodland, low Brigalow (*Acacia harpophylla*) open forest with tall Brigalow and *Eucalyptus cambageana* emergents, scrub of Brigalow and Poplar Box (*Eucalyptus populnea*), or open woodland of *Eucalyptus melanophloia*, *E. populnea*, *E. orgadophila* and *Acacia excelsa*, with ± open shrubby understorey. It grows in red cracking clay to brown loam soils. However, in the North Kennedy District it was collected from vinethicket on limestone karst-derived soils (*Fensham 1036*).

Etymology: the specific epithet (viz. *micranthum*) refers to the small corolla of this species that just extends beyond the calyx.

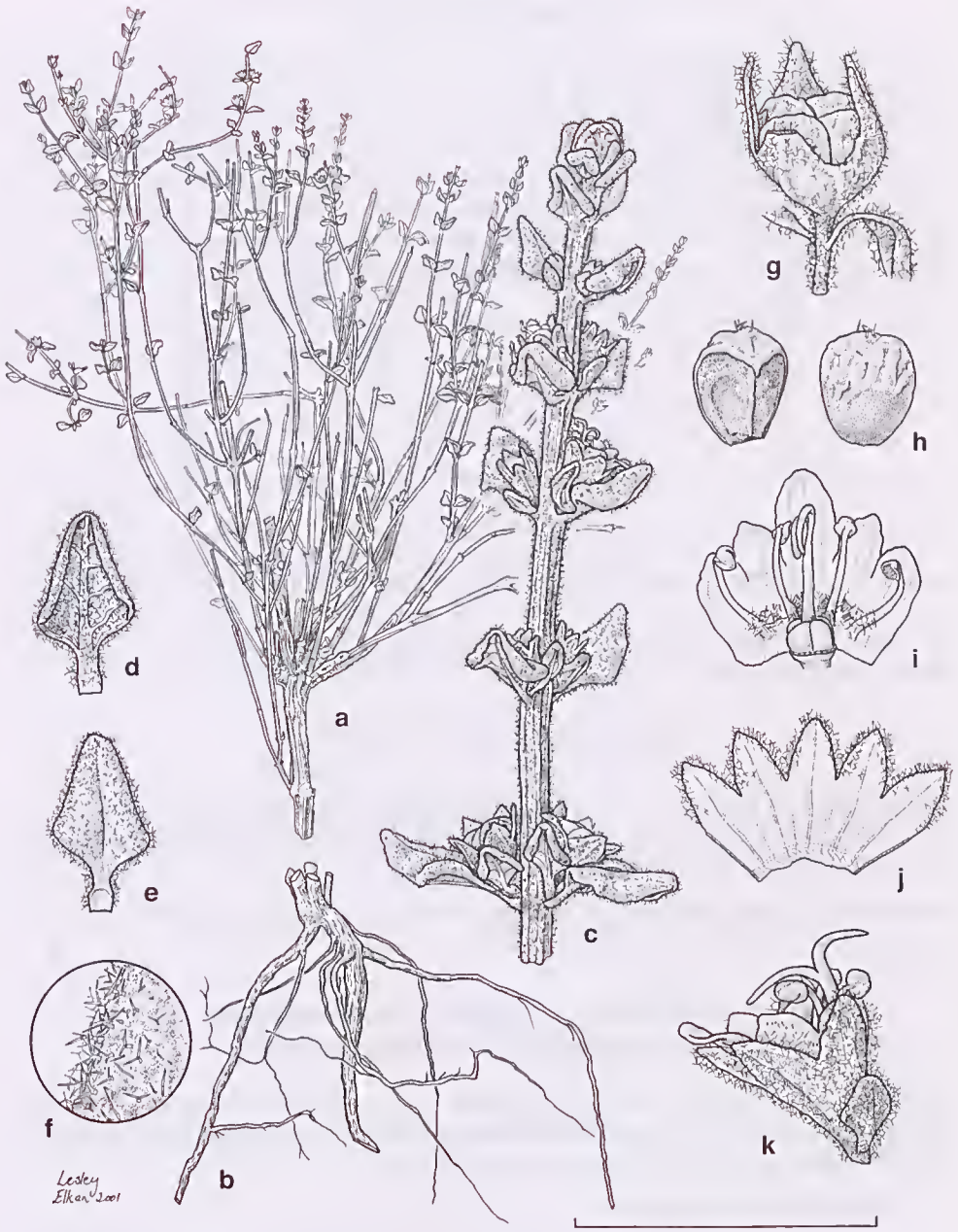

Fig. 1. *Teucrium micranthum* B.J. Conn **a,** habit (*Conn 4146*); **b,** root system (*Fell 850*); **c–k** (*Conn 4146*): **c,** branchlet, showing flowers and calyces in fruit; **d,** leaf, showing densely hairy abaxial surface and ± prominent veins; **e,** leaf, showing moderately to densely hairy adaxial surface; **f,** detail of branched hairs of adaxial leaf surface; **g,** fruit and fruiting calyx, showing prophylls; **h,** mericarps, left — showing radial and distal thickened surfaces, right — showing tangential and distal thickened surfaces; **i,** open corolla, showing hairy inner surface of tube, androecium and gynoecium; **j,** open calyx; **k,** flower, lateral view. Scale bar: a & b = 75 mm; c = 12 mm; d & e = 7.5 mm; f = 2.5 mm; g–k = 5 mm.

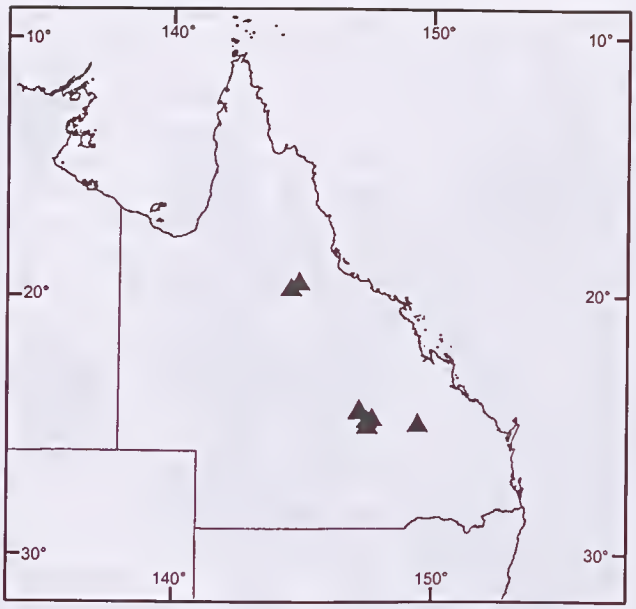

Fig. 2. Distribution map of *Teucrium micranthum*.

Notes: *Teucrium micranthum* is a subshrub characterised by a moderate to dense indumentum of multi-branched hairs and by ovate prophylls that are petiolate. The affinities of this species are not known.

Conservation status: this species does not appear to be rare or threatened and has been recorded in several National Parks.

Identification of *Teucrium micranthum* from other published Queensland species

The identification key provided by Bailey (1901, p. 1207) to the formally named species of *Teucrium* occurring in Queensland is here modified to distinguish this new species from the other species that have non-podiate flowers.

... Flowers sessile or nearly so

Leaves mostly 3–6 (or more)-lobed (14–20 mm long) .....**T. ajugaceum**

Leaves ± entire, toothed or rarely lobed

Branches, leaves and flowers moderately to densely hairy with branched hairs; leaves 4–7 mm long, margin entire; corolla small, just extending beyond the calyx .....**T. micranthum**

Branches, leaves and flowers moderately to densely hairy with unbranched hairs; leaves 15–50 mm long, margin regularly toothed or crenate; corolla distinctly exceeding calyx .....**T. argutum**

Acknowledgments

The botanical illustration of *Teucrium micranthum* was skillfully drawn by Lesley Elkan (NSW). David Fell (Queensland National Parks & Wildlife Service) first brought this taxon to my attention. Subsequently, Tony Bean (BRI) provided important additional information that enabled me to locate flowering plants of this species. Peter Bostock (BRI) kindly provided the collection information in an electronic form. Reed Beaman (NSW) prepared figure 2. I thank the Queensland Parks & Wildlife Service for assisting my research by providing scientific permits and the Service's field staff for generously sharing their local knowledge. I gratefully acknowledge the assistance of staff at the Queensland Herbarium (BRI) for access to their collections and facilities. I thank Elizabeth Brown and Natasha Leist (both NSW) (joint collectors of the type specimen) for their field assistance and companionship.

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Ranunculus meristus (Ranunculaceae), a new stoloniferous species from eastern Australia

Barbara G. Briggs and R.O. Makinson

Abstract

Briggs, Barbara G. and Makinson, R.O. (Royal Botanic Gardens, Mrs Macquaries Road, Sydney, NSW 2000, Australia) 2002. Ranunculus meristus *(Ranunculaceae), a new stoloniferous species from eastern Australia.* Telopea 9(4): *809–812.* **Ranunculus meristus** is described; it is widely distributed in intermittently wet habitats, mostly on heavy soils, in southern Queensland and inland New South Wales.

Introduction

An undescribed species of *Ranunculus* was included, as 'species A', in the *Flora of New South Wales* (Briggs & Makinson 1990, 2000). It is now described so that it can be included in the treatment of Ranunculaceae for the *Flora of Australia* (volume 2). Following the late Hansjorg Eichler's life-long interest in Ranunculaceae, his draft manuscript is being completed for the Australian Biological Resources Study by Neville Walsh and Jeff Jeanes (Eichler, Jeanes and Walsh, in preparation).

Ranunculus meristus *B.G. Briggs & Makinson*, **sp. nov.**

A *R.undoso* combinatione characterum sequentium distinguitur: divisiones laminae angustiores (0.5–2 mm latae); achenia minoria (praeter rostra c. 1.0–1.6 mm longa), cristis angustis transversalibus vel obliquis instructa; margines acheniorum haud vel leviter incrassatae.

Type: New South Wales: Central Western Slopes: Bow Creek, 12 km WSW of Merriwa on road to Mudgee, 32° 07′ 30″ S, 150° 15′ E, 17 Mar 1984, *B.G. Briggs 7430* (holo NSW; iso AD, BRI, CANB, CHR, HO, K, MEL, MO).

Stoloniferous perennial, glabrous or sparsely pilose; stolons stout 1.5–3 mm diam., arching and rooting at nodes. Flowering stems sparingly or repeatedly cymosely branched, mostly 15–50 cm high. Leaf blades 2.5–9 cm diam., palmately divided into acute or blunt segments that are mostly numerous and linear or very narrowly oblong, 0.5–1.5 mm wide, but in some (juvenile?) plants the segments are fewer and broader to 3 mm wide; petiole 5–20 cm long. Receptacle pilose in the staminal zone and among the achenes. Sepals 5, spreading, lanceolate or obovate, cymbiform, sparsely or densely pilose abaxially. Petals 7–11, obovate or narrow-obovate, 7.5–12.5 mm long, 2.5–5.5 mm wide; nectary in a pocket formed by a lobe attached laterally for most of its length. Achenes 30–85, mostly 1.0–1.6 mm long (excluding beak), the lateral faces with narrow transverse or diagonal ridges, the margins not or slightly thickened. (Fig. 1).

The epithet is from the Greek *meristos* = divided, divisible, referring to the finely divided leaf laminae.

Distribution: occurs from Springsure in Queensland south to Cootamundra in New South Wales; most common on the Darling Downs, the New South Wales Northern Tablelands and Central Western Slopes but extending to the northern edge of the

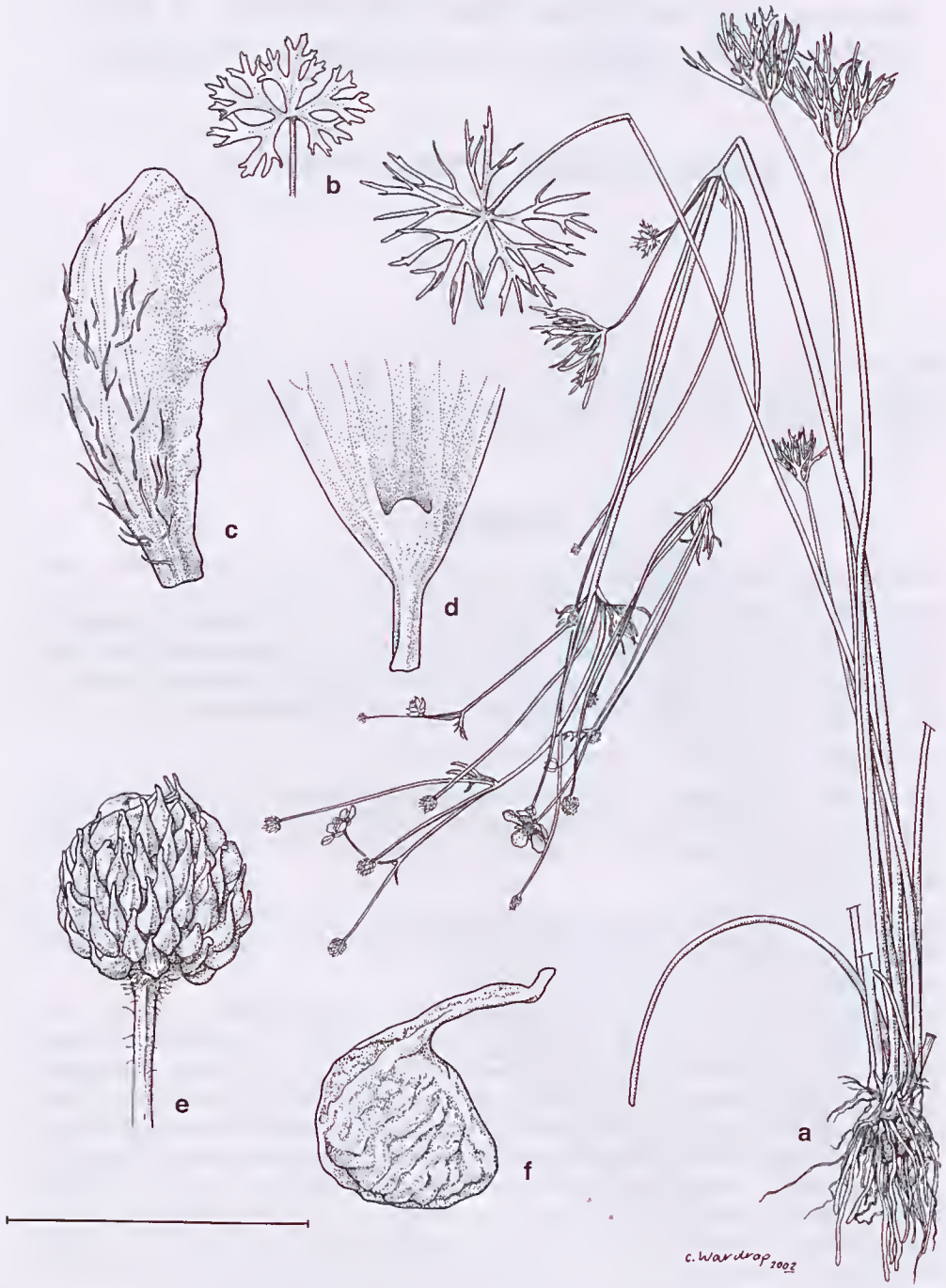

Fig. 1. *Ranunculus meristus*. **a**, habit. **b**, leaf showing broader segments. **c**, sepal, oblique abaxial view. **d**, petal base with nectary lobe. **e**, head of achenes. **f**, achene. (a, c–f from type collection; b from *Briggs 3457*). Scale bar: a, b = 10 cm; c, d = 4 mm; e = 1 cm; f = 2.4 mm.

South Western Slopes and the western edge of the North Coast and Central Coast. In intermittently wet swamps on heavy soils.

Conservation status: widespread and abundant in suitable habitats, not at risk.

Ranunculus meristus resembles *R. undosus* Melville and grows in similar habitats. It is distinguished from *R. undosus* by its narrower leaf segments and the smaller achenes which are not or slightly thickened at the margins and have narrow transverse or diagonal ridges. The leaf segments of *R. undosus* are mostly 2–8 mm wide and the achenes are 1.8–2.5 mm long (excluding the beak), with broad pale thickened margins (especially dorsally) and broad rounded ridges on the lateral faces. Much of the range of *R. meristus* lies to the north and east of that of *R. undosus*, but the distributions overlap extensively. *Ranunculus meristus* differs from *R. inundatus* R. Br. ex DC. in having larger leaves, pilose sepals, larger petals, achenes with distinct narrow ridges and the receptacle pilose among the achenes. *Ranunculus inundatus* has leaf laminae 1–3.5(–5) cm diam., glabrous sepals, petals 4.5–7 mm long and 2–3 mm wide, lateral faces of achenes mostly smooth or irregularly undulate but rarely with transverse ridges, and the receptacle almost glabrous among the achenes (although pilose in the staminal zone). *Ranunculus inundatus* grows mostly in permanently wet sites, whereas the other two species are mostly in intermittently wet habitats. Specimens received from veterinary officers indicate that, as with many other *Ranunculus* species, *R. meristus* has been implicated in cases of poisoning of stock (e.g. cattle).

At the type locality it was noted by Briggs (and also at Bow Creek by Jacobs and Lapinpuro) that apparent clones varied considerably in the width of leaf segments. The broader leaf segments are mostly in non-flowering plants and may represent a juvenile leaf form. From the Central Western Slopes there are also several collections that may represent an extreme variant of *R. meristus* (not covered by the description above) or may be a distinct taxon. These have leaf laminae divided into only three, cuneate, lobed segments: Bow Creek, 12 Mar 1978, *Jacobs 3339, Sainty 580* (NSW); Coolah, Nov 1964, *Darville* (NSW 77625); Coolaburragundy River S of Pandoras Pass, *L.A.S. Johnson* (NSW 53964); Scone District, Nov 1964, *A.J. Boyle* (NSW 77626); Lees Pinch crossing of Goulburn River, 16 Nov 1974, *K.L. Wilson 704, L.A.S. Johnson & S. Jacobs* (NSW); Cassilis, 29 Aug 1958, *A. Busby* (NSW 46006); Denman, Jan 1909, *W. Heron* (NSW 44991); Kerrabee (as Karabee), Nov 1912, *L. Tindale* (NSW 44989).

A flowering specimen purported to be from New South Wales South Coast (Batemans Bay, Jun 1906, *J.L. Boorman* [NSW 45025]) is probably wrongly labelled. The locality is remote from other collections and the species rarely flowers in winter.

Selected specimens examined: Queensland: Leichhardt: Springsure, Oct 1913, *E. Jarvis* (BRI 1138). Maranoa: Dooloogarah, 130 km NW of Injune, 19 Apr 1999, *R. Fensham 3701* (BRI, NSW). Wide Bay: Gympie, Jan 1907, *F.H. Kenny* (BRI 1090). Moreton: Yarraman, Dec 1956, *W.T. Jones* (BRI 10087); Heifer Ck, c. 2 miles [3 km] N of West Haldon, 2 Oct 1960, *L. Pedley 696* (BRI). Darling Downs: summit bog, Bunya Mts, 24 Mar 1944, *M.S. Clements 43923* (A–GH); Jimbour [as Jimbo], plains of the Condamine, *L. Leichhardt* (NSW 44979); Dalby to Chinchilla, 4 Sep 1978, *T.D. Stanley & S.T. Reynolds 7825* (BRI); Warrego Hwy, 10 km W of Dalby, 2 Oct 1975, *K.A. Williams 75093* (BRI); 7 miles [11 km] W of Dalby, 3 Sep 1956, *N.T. Burbidge* (CANB 5458, NSW); Merritts Creek road, W of Hampton, 26 Jan 1995, *A.R. Bean 8197* (BRI, NSW); Clifton, Kings Ck, 17 Mar 1971, *S.R. Walsh 771* (BRI).

New South Wales: North Coast: Curricabark, NW of Gloucester, 4 Apr 1969, *B.G. Briggs* (NSW 124376); c. 1.5 km W of 'Myra' homestead, NW of Gloucester, 22 Sep 1968, *D. Blaxell & R. Coveny 577* (NSW). Central Coast: Colong Creek, S of Yerranderie, 5 Dec 1911, *R.H. Cambage 3214* (NSW). Northern Tablelands: Glen Innes, Dec 1913, *J.L. Boorman* (NSW 45039), 8 Dec 1924, *E. Cheel* (NSW 45041); Tenterfield to Sandy Flat, Dec 1898, *J.H. Maiden* (NSW 45038); Blackfellows Gully, E of Walcha, 12 Jan 1958, *N.C. Ford* (NSW 45027); Tia to Walcha, Nov 1897, *J.H. Maiden* (NSW 45046). North Western Slopes: E of Woodsreef Mine, 27 Oct 1992, *J.R. Hosking 606* (NSW, CANB, MEL, NE); 9 km S of Limbri, 4 Jan 1989, *J.R. Hosking* (NSW 218627); 15 km NW of Wandsworth on Tingha road, 26 Nov 1982,

S. Jacobs & L. Lapinpuro LL 18 (NSW). Central Western Slopes: 14 km N of Rylstone, 9 Nov 1989, *W. Semple OR169* (NSW); Blandford, Oct 1922, *C.L.O. Gorman* (NSW 45045); c. 7.3 km SW from the Merriwa–Cassilis road towards Wollar, 7 Nov 1969, *R. Coveny 2426, 2427* (NSW, K); Bow Creek, 10 km WSW of Merriwa, 14 Mar 1970, *B.G. Briggs 3457* (NSW, BRI); Spring Creek, 10 km SW of Merriwa, 14 Mar 1970, *B.G. Briggs 3458* (NSW, K). South Western Slopes: Harden, 7 Mar 1975, *J. Kenison* (NSW 517937); Barthong, Cootamundra district, 18 Dec 1975, *J. Whiteley* (NSW 517936).

Acknowledgments

We thank Neville Walsh and the late Dr Hansjorg Eichler and for valuable discussions of this species, Dr Tony Orchard for making available to us Dr Eichler's draft manuscript for the *Flora of Australia*, Catherine Wardrop for the illustration and Dr Peter Wilson for assistance with the Latin diagnosis.

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A new species and new combination in *Craspedia* (Asteraceae) from Tasmania

Andrew C. Rozefelds

Abstract

Rozefelds, A. C. (Tasmanian Herbarium, GPO Box 252–04, Hobart, Tasmania 7001, Australia) 2001. A new species and new combination in Craspedia *(Asteraceae) from Tasmania.* Telopea *9(4): 813–820.* **Craspedia glabrata** (Hook.f.) Rozefelds from subalpine communities in Tasmania is recognised as a distinct species. It is distinguishable from all mainland Australian and Tasmanian taxa by its small size, white florets and narrowly oblanceolate, pale green leaves. **Craspedia preminghana** Rozefelds is characterised by its white florets and broad oblanceolate-obovate, green leaves with multiseptate hairs and is known only from the type locality at Preminghana (Mount Cameron West) in north-western Tasmania. The distribution and conservation status of both species are examined.

Introduction

Craspedia has proved to be a difficult genus taxonomically, and with the exception of the flora treatment in Curtis (1963), it has not been critically studied in Tasmania. Currently four *Craspedia* species (Buchanan 1999), one of which consists of four varieties, are recorded from Tasmania. However, there is no recent key to these taxa and the species limits and the diagnostic characters that define each species remain unclear. In the absence of a modern treatment of the Tasmanian species it is also unclear whether any of these species should be listed as rare or threatened. This lack of study has led to the delisting of taxa, e.g., *Craspedia glauca* var. *glabrata*, from the revised list of threatened species for the State (W. Potts pers. comm. 2001). A taxonomic revision of the genus in Tasmania is therefore the first step in assessing whether any of the taxa are threatened and should be listed under the Tasmanian Threatened Species Act. It also allows the species of *Craspedia* in Tasmania to be critically compared with those from mainland Australia, and New Zealand.

It has become evident, in undertaking this study, that resolution of the taxonomic problems in *Craspedia* in Tasmania is reliant upon the availability of good herbarium specimens, supported by field observations of living plants. Existing herbarium collections are often information-poor and lack notes on floret and anther colour, root characters, leaf appearance (i.e., whether the leaves are flat, or u- or v-shaped in cross section) and habitat information (e.g., landform, soil type and associated vegetation). Recent research by Bridle & Kirkpatrick (2001) has also shown that flowering time is important in delimiting species.

This is the first in a planned series of papers on *Craspedia*, in Tasmania, and two distinctive species with white florets are described. The morphology, distribution, ecology and conservation status of each species is discussed. The two species are compared with other Australian species of *Craspedia* that have white florets. The Tasmanian biogeographical regions used are those of Orchard (1988).

Taxonomy

Craspedia glabrata *(Hook.f.) Rozefelds*, **comb. nov.**

Basionym: *Craspedia richea* Cass. (sp. nom. illeg.) var. *glabrata* Hook.f. *Lond. J. Bot.* 6: 118 (1847).

Craspedia glauca (Labill.) Sprengel var. *glabrata* (Hook.f) Curtis (comb. inval.), *Student's Flora of Tasmania* 2: 347 (1963).

Remarks: This species was described as a variety of *C. richea* Cass. by Hooker (1847). The species name, *Craspedia richea* Cass. is illegitimate, as the basionym for this species is *Richea glauca* Labill. (Chapman 1991). Curtis (1963) attempted to rectify this mistake by transferring the variety *glabrata* to *C. glauca*. The new combination *C. glauca* var. *glabrata* Hook.f., however, is invalid, as the original reference and date of publication were not cited (Chapman 1991).

Type: Marlborough, Tasmania, *Gunn 1159* 8 Jan 1841, lectotype K **[here designated]** n.v., Cibachrome HO ! (Fig. 1).

Vernacular name: Little Alpine Billy Button.

Small *herb* with usually a single flowering scape 8–18(–30) cm high, roots thick, tomentose covered with fine brown hairs. *Leaves* mostly basal, narrowly oblanceolate to almost linear, 3.5–7.0 cm long, 2.5–4.0 mm wide, margins entire, glabrescent, concolorous, pale green with slight bluish tinge, usually v-shaped in cross section *in vivo*, usually one prominent mid vein, upper leaf surface with a few stalked glandular hairs, c. 0.1 mm long, and arachnoid hairs on the leaf margins and sometimes over the entire leaf surface, lower leaf surface with occasional stalked glandular hairs c. 0.1 mm long, and scattered arachnoid hairs, occasionally widespread giving a weakly tomentose appearance, leaf base purplish, old leaf bases retained. *Bracts* 4–8, becoming progressively shorter and narrower distally, leaf-like near base, up to 25 mm long, and up to 2.5 mm wide, margins entire, wrapping halfway around but not obscuring the scape, distal bracts linear, 6–10 mm long, 0.8–1.2 mm wide, margins entire. *Inflorescence* a single globose, terminal compound head. *Scape* purplish, 0.8–2.0 mm thick, usually with scattered, long, fine arachnoid hairs, particularly near the base of the compound head. *Compound head* hemispherical-spherical, 8–12 mm in diameter, with 25–40 partial heads. *Partial heads* near base of compound head, with 3–6 florets, main bract of the partial involucre broadly triangular, with a green ovate-triangular, glandular and herbaceous stereome, arachnoid hairs near the base, and light brown membranous margins. *Corolla* white. *Anthers* tailed, cream. *Achenes* 1.5–1.7 mm long with small scattered glandular hairs, covered by a dense indumentum of fine silky hairs; pappus of 11–16 colourless plumose bristles c. 3 mm long.

Selected specimens examined: Tasmania: Ben Lomond: SE of Ski Village, Ben Lomond National Park, 41°31'08"S 147°40'07", wet seepage areas in alpine shrubland, on dolerite, altitude 1460 m, *Rozefelds 1597*, 29 Jan 2000 (HO504310); Slopes behind Ben Lomond Ski Village, 41°32'S 147°40'E, on dolerite, altitude 1480 m, *Rozefelds 116*, 2 Mar 1996 (HO316207). Central Highlands: Camerons Lagoon, near Great Lake, 41°57'27"S 146°40'43"E, altitude 1040 m, *Rozefelds 1589*, 23 Jan 2000 (HO504428); Camerons Lagoon, 41°57'S 146°40'E, altitude 1040 m, on basalt, *K. Bridle s.n.*, 16 Jan 2000 (HO504228); Table Mountain, NW Slope, 42°14'S 147°08'E, *M.T. Davis 1128*, Mar 1954 (HO10844); near Interlaken, 42°09'S 147°10'E, altitude 1000 m, marshland, *M.T. Davis 1139*, Mar 1954 (HO10847); 10 mls [16 km] N.E. of Bothwell, 42°17'S 147°05'E, marsh, *J. Somerville s.n.*, 22 Dec 1958 (HO10846); and *W.M. Curtis s.n.*, 22 Dec 1958 (HO52705); Flagstaff Creek, St Patricks Plains, 42°02'S 146°46'E, *A.M. Buchanan 6302*, 22 Mar 1985 (HO410606); Millers Bluff, 41°56'S 147°10'E, *Astelia alpina* wetland, *A. Moscal 18935*, 25 Feb 1990 (HO144238); Alma Tier (Interlaken Road) 42°08'S 147°04'E, montane grassland, altitude 1000 m, *L. Gilfedder 17*, 10 Feb 1991 (HO443077). East Coast: 1.5 km E of Apsley Marshes, 41°57'S 148°13'E, in heath sedgeland, altitude 15 m, *A. Moscal 8537*, 7 Oct 1984 (HO400801).

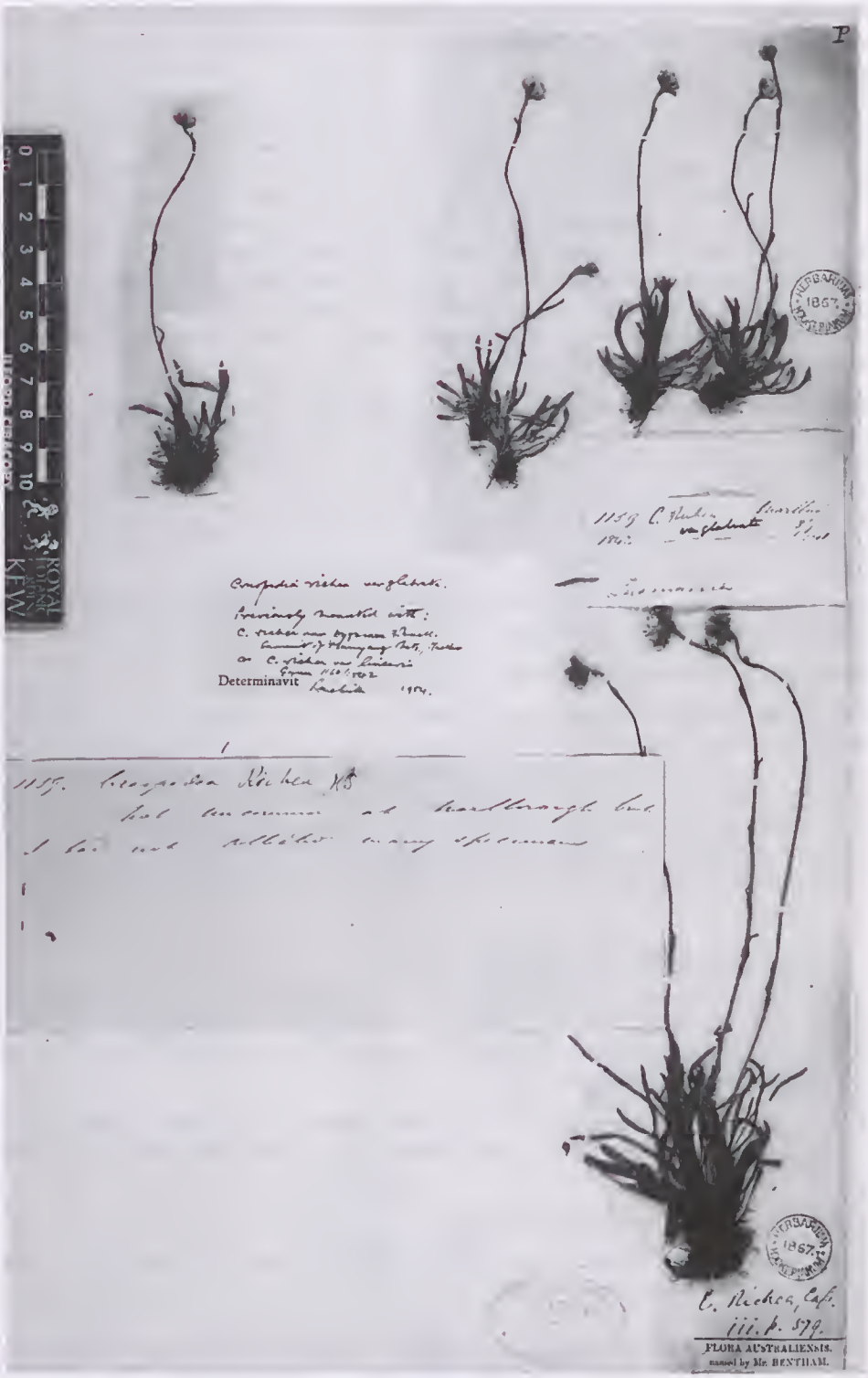

Fig. 1. Lectotype of *Craspedia glabrata* (Hook.f.) Rozefelds (*Gunn 1159,* K). The lectotype is the right hand specimen of the three specimens in the top right hand corner.

Remarks: Hooker (1847) in describing *C. richea* var *glabrata* questioned whether it required specific rank. Curtis (1963) proposed a new combination *C. glauca* (Labill.) Sprengel var *glabrata*, that although illegitimate, suggested affinities with *C. glauca*. *Craspedia glabrata* can be easily distinguished from *C. glauca* by its narrowly oblanceolate leaves and white florets. Four *Craspedia* species in mainland Australia and Tasmania have white florets, and they differ from *Craspedia glabrata* in a number of vegetative and reproductive characters (Table 1). *Craspedia alba* Everett & J.Thompson (mainland Australia) can be distinguished from *C. glabrata* by its more robust, oblong to oblanceolate leaves, and the silvery appressed hairs on the leaves and scape (Table 1). *Craspedia alpina* Backh. ex Hook.f. (Tasmania) has much larger spathulate leaves with white woolly hairs, and it also has much larger compound heads (Table 1). *Craspedia leucantha* F.Muell. (mainland Australia) differs from *C. glabrata* in having larger spathulate leaves that are 7–14 cm in length and 5–25 mm in width (Everett & Doust 1992).

Distribution: *Craspedia glabrata* is known from the Central Highlands and Ben Lomond Plateaus (Fig. 2). The type (*Gunn 1159*) is from Marlborough, a locality that no longer exists, but it equates to an area on the Nive River, near Bronte in Central Tasmania. All the current collections referred to *C. glabrata* are from subalpine and alpine areas above 800 m in Tasmania, with the exception of a lowland collection (*Moscal 8537*) from the Apsley Marshes in eastern Tasmania which has been tentatively referred to this species (Fig. 2).

Habitat: The species has been collected from moist, poorly drained soils and swampy areas, or occasionally from grassland.

Flowering period: December–March.

Conservation status: This taxon, as *Craspedia glauca* var. *glabrata*, was listed as 'Rare' in the Tasmanian Threatened Species Protection Act (Anon 1995). As its taxonomic status was unclear, along with all the other varieties of *C. glauca* recognised by Curtis (1963), it was delisted from the draft list of threatened species for the State (W. Potts pers. comm. 2001). While there are only relatively few herbarium collections in the Tasmanian Herbarium, the widespread nature of the existing collections, and supporting field observations, suggest that it is not threatened (Fig. 2).

Craspedia preminghana Rozefelds **sp. nov.**

A *Craspedia alba* Everett & J.Thompson, *C. leucantha* F.Muell., *C. glabrata* (Hook.f) Rozefelds et *C. alpina* Backh. ex Hook.f. combinatione characterum sequentium distinguitur: foliis oblanceolatis-obovatis prasinis, 13–20 cm longis, 2.0–3.4 cm latis cum pilis multiseptatis longis.

Type: Tasmania, Preminghana (Mt Cameron West), North West Coast, 40°52'S 144°42'E, *A. Moscal 27954B*, 9 Jan 1996, altitude 65 m, on cliff base, scree boulder slope (holo HO319514).

Vernacular name: Preminghana Billy Button

Robust *herb* with one to three scapes up to 36 cm high, roots thick, tomentose covered with fine brown hairs. *Leaves* mostly basal, broadly oblanceolate to spathulate, 13–20 cm long, 2.0–3.4 cm wide, margins entire, hispidulous, discolorous, dull green above, light green below, and flat to slighty concave in cross section *in vivo*, prominent mid vein and two conspicuous lateral veins that extend to the apex, upper leaf surface with scattered hairs consisting of longer multiseptate hairs up to 0.4 mm long, and smaller stalked glandular hairs, c. 0.1 mm long, with a conspicuous rim of multiseptate, stalked glandular and scattered arachnoid hairs along the margins, lower leaf surface

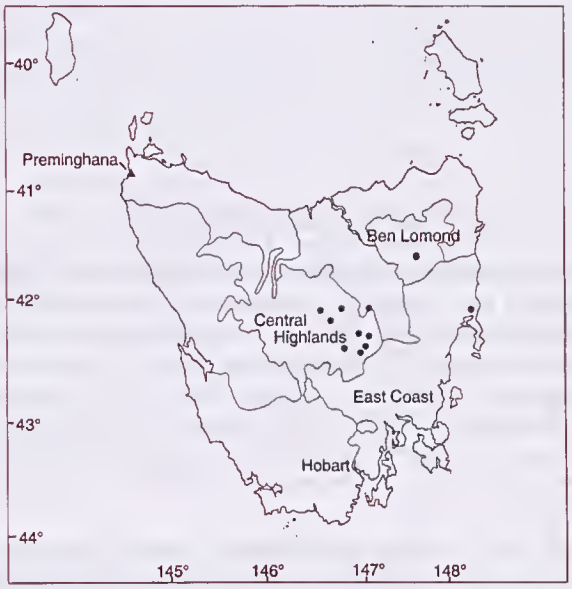

Fig. 2. Map showing the distribution of *Craspedia glabrata* (circles) and *C. preminghana* (triangle) based upon Tasmanian Herbarium (HO) records.

Fig. 3. *Craspedia preminghana.* Habit, and detail of involucral bract of compound head. *del.* D. I. Morris.

with a greater density of scattered hairs, consisting of multiseptate hairs up to 0.5 mm long, and smaller stalked glandular hairs c. 0.1 mm long, particularly along margins and veins, leaf bases purplish *in vivo*, old leaf bases retained. *Bracts* 5–9, becoming progressively shorter and changing shape distally, leaf-like in size and shape near base, margins entire, narrowly attached and not obscuring the scape, middle bracts broadly ovate to lanceolate, up to 60 mm long and 25 mm wide, margins undulose to entire, stem clasping with basal margins sometimes obscuring the scape, distal bracts, lanceolate-linear, 8–15 mm long and 4–6 mm wide, margins entire, wrapping halfway around stem but not obscuring scape. *Inflorescence* a single globose, terminal compound head. *Scape* green to purplish, 4–5 mm thick, surface slightly ridged, with long multiseptate hairs to c. 1 mm long, and stalked glandular hairs. *Compound head* spherical, c. 25–35 mm in diameter with up to c. 60–100 partial heads. *Partial heads* near base of compound head with 5–7 florets, main bract of the partial involucre ovate-triangular, with a green ovate to triangular, glandular and herbaceous stereome, and dark brown membranous margins. *Corolla* creamy white. *Anthers* tailed, yellow. *Achenes* 2–3 mm long (not mature) with small scattered glandular hairs, covered by a dense indumentum of fine silky hairs; pappus of 12–16 colourless plumose bristles, 4–5.5 mm long. (Fig. 3).

Specimens examined: Tasmania: West Coast: All from Preminghana (Mount Cameron West), 40°52'S 144°42'E, altitude 80 m, *Rozefelds 1340 & A.M. Buchanan*, 21 Jan 1999 (HO441379); altitude 80 m, *Rozefelds 1341*, 21 Jan 1999 (HO441463); 40°51'55"S 144°42'15"E, *Rozefelds 1857 & W.A. Gebert*, 27 Sep 2000 (HO509227); 40°52'S 144°42'E, *F. Coates s.n.*, 10 Jan 1989 (HO114134).

Derivation: Preminghana is the Tasmanian Aboriginal name for the locality.

Remarks: *Craspedia preminghana* can be distinguished from *C. alpina* Backh. ex Hook.f. (Tasmania) and *C. alba* Everett & J.Thompson (mainland Australia) by its green foliage and the conspicuous multiseptate hairs on the leaves and scape (Table 1). *Craspedia leucantha* F.Muell. (mainland Australia) differs from *C. preminghana* in having almost glabrous leaves and a smaller compound head (Table 1) (Everett & Doust 1992). *Craspedia preminghana* can be distinguished from *C. glabrata* by its broadly oblanceolate to spathulate leaves, multiseptate hairs on leaves and scape, and also by its much larger compound head (Table 1). The flowers of *C. preminghana* are honey-scented, and the leaves when crushed have a conspicuous lemon-mint smell.

Distribution: Presently known only from the type locality, Preminghana in north western Tasmania (Fig. 2). Fieldwork at nearby Woolnorth Station in north western Tasmania, which has a similar geology and aspect to Preminghana, did not locate additional populations of this species.

Habitat: Known to occur only on steep basalt cliffs with coastal vegetation including *Correa backhousiana*, *Alyxia buxifolia* and *Urtica incisa* (narrow-leafed coastal form). The vegetation of Preminghana (Mount Cameron) and adjoining coastal areas was described by Brown (1980).

Flowering period: October – January.

Conservation status: The plants have been collected from steep slopes of Mount Cameron, which are difficult to access and the number of plants in the population is therefore difficult to ascertain. It is thought that the entire population consists of fewer than 200 plants. The species therefore requires listing under the Australian Environmental Protection and Biodiversity Conservation Act (1999) as 'Critically Endangered' as it is known from only one locality and has an estimated population size of less than 250 mature plants. Field studies by Bridle and Kirkpatrick (2001) have shown that grazing pressure from both marsupials, and/or introduced mammals, impacts negatively on *Craspedia* species in the Central Highlands of Tasmania.

Craspedia preminghana grows on steep, almost vertical, cliff edges on Preminghana, and its survival may be due to the likely absence, or reduced impact of grazing in these areas. Under the guidelines for the listing of species under the Tasmanian Threatened Species Protection Act (Anon 1995) the species would be listed as 'Endangered' — total population less than 250 individuals.

Acknowledgments

I wish to thank Alex Chapman (ABLO) for his help in obtaining Cibachromes from K of Tasmanian type material. The Tasmanian Aboriginal Land Council allowed access to Preminghana. Alan Gray kindly grew on some plants collected from Preminghana for the author, and Dennis Morris prepared Fig. 3. NSW loaned comparative material of mainland species for study and Joy Everett (NSW) has provided advice on taxonomic problems within the genus and her editorial advice has considerably improved the manuscript.

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Systematics of *Eidothea* (Proteaceae), with the description of a new species, *E. hardeniana*, from the Nightcap Range, north-eastern New South Wales

Peter H. Weston and Robert M. Kooyman

Abstract

Weston, P.H.[1] and Kooyman, R.[2] ([1]National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, NSW 2000, Australia; [2]Earth Process Ecological Services, 220 Dingo Lane, Myocum, NSW 2482, Australia) 2002. Systematics of Eidothea *(Proteaceae), with the description of a new species,* E. hardeniana, *from the Nightcap Range, north-eastern New South Wales.* Telopea *9(4): 821–832.* **Eidothea hardeniana** P.H. Weston & R.M. Kooyman, a new species from the Nightcap Range, New South Wales, is named and described and its collection history discussed. The only other species of *Eidothea*, *E. zoexylocarya*, is also redescribed and the two species are compared. The morphology, phylogeny, classification, biogeography and character phylogeny of *Eidothea* are also briefly discussed.

Introduction

In October 2000 we collected fertile material of an unnamed species of the genus *Eidothea* (Proteaceae), from the Nightcap Range in north-eastern New South Wales. In this paper we name it *E. hardeniana*, as well as redescribing its sister species, *E. zoexylocarya*, and the genus as a whole. We also discuss its collection history, phylogenetic relationships, and aspects of its morphology.

The Nightcap *Eidothea* was probably first collected in 1953 by L.J. Webb and J.G. Tracey, as part of their ecological survey of Whian Whian State Forest. Their specimen is sterile, with spinose-dentate juvenile foliage. They identified it as *Lomatia arborescens* (Proteaceae), which it superficially resembles, differing most obviously in its pseudoverticillate phyllotaxis. The specimen was sent to BRI, where it was incorporated into the herbarium collection. It was redetermined in 1979 as an unnamed species of *Corynocarpus* (Corynocarpaceae).

A similar specimen, bearing no information other than 'coppice leaves', was sent by H.C. Hayes to BRI, apparently at a later date. This was also incorporated into the herbarium, and was labelled 'H.C. Hayes, Coffs Harbour'. This specimen was matched with that of Webb and Tracey, and determined as *Corynocarpus* sp.

Coffs Harbour, however, is unlikely to be the true collection locality. Alex Floyd (in litt.) writes of Hayes:

> Harold Hayes was my botanical assistant here at Coffs Harbour from 1956 until his retirement about 20 years later. He was an authority on field identification of New South Wales rainforest trees and was in great demand for field trips with C.T. White, Laurie Johnson, Lyn Pryor and Len Webb. Trees named after him include Endiandra hayesii, Melicope hayesii and Symplocos hayesii (North Queensland). Harold lived here in Coffs Harbour, but our area extended from the Hawkesbury River to the Queensland border. Harold had a special love for Whian Whian State Forest and made many collections from there. I have no doubt that this was where he collected the Eidothea specimen. Possibly he sent it up from Coffs Harbour to his good friend Lindesay Smith at the Brisbane Herbarium for identification.

The Nightcap *Eidothea* then went uncollected until 1988, when one of us (RMK) found similar juvenile material in Nightcap National Park. In August 2000, RMK discovered mature trees and collected basal subsidiary shoots, wood, and gnawed fruits, which he sent to NSW for identification. The wood displayed the wide rays characteristic of most members of the Proteaceae and the fruit structure was so similar to that of the recently described *Eidothea zoexylocarya* (Douglas & Hyland 1995a, b) that both of us concluded that it must be a species of *Eidothea*. Adult, flowering material that we collected in October 2000 further confirmed the generic identity of this species and allowed detailed comparison with *Eidothea zoexylocarya*. This led us to conclude that although the Nightcap *Eidothea* closely resembles *E. zoexylocarya*, it is morphologically distinct from it.

Morphology

Douglas and Hyland (1995b) deal succinctly with the morphology of *Eidothea* but a few supplementary comments are necessary.

Firstly, the fruit is not a 'nut', contrary to Douglas and Hyland's description. Recently published botanical English glossaries (e.g. McCusker, 1981: 183, Harden 2002: 650) define a nut as a dry, indehiscent fruit formed from two or more carpels but containing only one seed. Since the flower of *Eidothea* possesses only one carpel (as do all Proteaceae) the fruit cannot be a nut, according to this definition. Older English and German botanical literature (e.g. Bentham 1863, Troll 1957) defines 'nut' more broadly to include dry fruits developed from a single carpel. However, In both species of *Eidothea* the pericarp is differentiated into three layers: a thin epidermis, a softly fleshy but not very succulent mesocarp, and a hard, bony inner layer. The term 'drupe' has usually been used for such fruits, although it has also been applied inconsistently (see Clifford & Dettmann 2001 for a recent review of usage of the term 'drupe'). For example, some definitions restrict its use to fruits in which the inner bony layer, the endocarp, develops exclusively from the inner epidermis of the carpel, while other definitions are based on the anatomy of the mature fruit, regardless of organogeny (Clifford and Dettmann 2001). Since fruit organogeny is known for a only a minority of taxa, the latter class of definitions is much more widely applicable than the former. Clifford and Dettmann (2001) conclude their discussion by proposing a definition of the term 'drupe', based solely on gross anatomy. Under this definition, the fruit of *Eidothea* is a drupe and this is the terminology that we have adopted.

In both species the inflorescence axis is a flattened receptacle on which sessile flowers are crowded. Mature inflorescences consist of one or two central flowers, one of which is sometimes bisexual (the others being male), surrounded by a false whorl of male flowers. Many of the inflorescences of both species that we have examined are wholly male, having no bisexual flower. Douglas and Hyland (1995b: 127) describe the inflorescence of *E. zoexylocarya* as 'a capitulate raceme' and 'forming condensed racemes, usually one flower perfect, the others male'. Although detailed developmental study of inflorescences of *E. zoexylocarya* (Andrew Douglas pers. comm.) corroborates this interpretation, some additional qualifying comments based on our dissections of mature inflorescences are necessary. Firstly, Douglas and Hyland (1995b: 127) state that the flowers are 'solitary in each bract axil'. However, we could find no bracts subtending the central flower(s) in either species and they are presumably so reduced in the mature inflorescence as to be functionally absent. They are very much smaller than the prominent bracts that subtend the outer false whorl of flowers. Similarly, we could find no terminal bud at or near the centre of the inflorescence in either species, although Andrew Douglas (pers. comm.) has observed the presence of 'a residuum of the inflorescence apex' in developing inflorescences of *E. zoexylocarya*. Given their close similarity, the structure and development of the inflorescence of *E. hardeniana* is most likely to correspond to that of *E. zoexylocarya*.

In other respects, the inflorescence of *E. hardeniana* appears to differ significantly from that of *E. zoexylocarya*, although attached to this assertion is the caveat that we have been able to make a detailed examination of floral material from only one tree of *E. hardeniana*. The majority of bisexual flowers of *E. hardeniana* that we have examined have 5 tepals. Some of these flowers are truly 5-merous, having five stamens; others, however, have only four stamens, one of which is inserted between two of the tepals. All of the flowers of *E. zoexylocarya* that we have examined have been 4-merous.

Phylogeny, Classification, Biogeography and Character Phylogeny

Douglas and Hyland (1995a, b) erected a new monogeneric subfamily for *Eidothea* on the grounds that 'The combination of plesiomorphic and apomorphic features suggests that *Eidothea* represents a new subfamily, one possibly leading to the line of Proteoideae' (Douglas & Hyland 1995b: 128). However, a subsequent molecular systematic analysis (Hoot & Douglas 1998), based on chloroplast DNA sequence data, showed that *Eidothea* is nested within the subfamily Proteoideae. Moreover, it is more closely related to all but two genera of Proteoideae, than any of them are to *Agastachys* and *Symphionema*. This clade received 85% bootstrap support in Hoot and Douglas's analysis of their 'combined' data set. The Eidotheoideae thus renders the Proteoideae paraphyletic as presently circumscribed. The simplest taxonomic change that would solve this problem would be inclusion of *Eidothea* in the subfamily Proteoideae.

The strict consensus from Hoot and Douglas's 'combined' data set places *Eidothea* as part of a trichotomy at the node above the base of the Proteoideae. One of the other two clades that branch from this node includes two subclades that span the Indian Ocean. If the Proteaceae really is a Gondwanic taxon (see e.g. Weston & Crisp 1996), then these subclades date back to the rifting of Africa from the rest of Gondwana, about 100 million years ago (Pitman et al. 1993). The age of the more basal *Eidothea* lineage would then be older than this.

Hoot and Douglas's (1998) results allow us to reassess the homology and polarity of characters in *Eidothea* within a corroborated phylogenetic framework. Character states such as pseudoverticillate phyllotaxis and, longitudinal ribs on the inner surface of the endocarp are unique in the Proteoideae and are thus clearly interpretable as generic synapomorphies (sensu Hennig 1966). Andromonoecy (*sensu* Walker & Whelan 1991) is rare in the Proteoideae, being otherwise known only in *Stirlingia* (Connell & Ladd 1994, McCarthy 1995), but this is most parsimoniously interpreted as having arisen independently of andromonoecy in *Eidothea*. This condition can therefore be tentatively added to the list of generic synapomorphies.

Differences between the two species of *Eidothea* are mostly much more difficult to resolve as autapomorphies, given the size and morphological diversity of the relevant outgroups. A tendency in *E. hardeniana* to produce 5-merous bisexual flowers might, on further sampling, prove to be the only unequivocal autapomorphy.

Eidothea A.W. Douglas & B. Hyland

Douglas and Hyland (1995a: 472); Douglas and Hyland (1995b: 127).

Type species: *Eidothea zoexylocarya* A.W. Douglas & B. Hyland

Andromonoecious trees. Bark grey, compact. Trichomes simple. Shoots composed of a succession of repeated growth units, each consisting of a basal false internode and a terminal false whorl of leaves; false internodes bearing numerous spirally inserted scale leaves which are crowded, imbricate, persistent and broad-ovate to orbicular at the base, becoming uncrowded, mostly caducous and narrow-triangular more distally; false whorls bearing (2–)3–17 crowded, spirally inserted leaves. Leaves simple, the

undersurface paler than the upper surface; juvenile leaves with dentate or entire margins; adult leaves entire. Inflorescence a lateral, axillary or ramiflorous, shortly pedunculate capitulate raceme, with one or two central, vestigially bracteate flowers, one of which may be bisexual, surrounded by a false whorl of prominently bracteate male flowers, with narrow tufts of erect trichomes arising from the axis between the flowers. Flowers with tepals becoming circinate at anthesis; male flowers usually slightly asymmetrical due to slight compression and incurving at the base, but otherwise actinomorphic, 4-merous, with or without a central, sterile gynoecium; bisexual flowers actinomorphic, slightly larger in size than male flowers, 4-merous or sometimes 5-merous (only in *E. hardeniana*). Tepals free except for a short, basal tube, valvate, approximately oblong in shape but slightly constricted at the tip of the basal tube and narrowing abruptly to a truncate base and an acute tip, glabrous externally, with long trichomes at base but otherwise glabrous internally, creamy white when fresh. Stamens free or the filaments slightly adnate to the base of the tepals, creamy white, longer than the tepals in bud; filaments filiform, tapered from base to tip, with a sinuous, double fold between the midpoint and the tip in bud, glabrous or with scattered antrorse marginal hairs in the basal half, weak, not supporting the anthers; anthers narrow-oblong, slightly tapered towards tip, latrorsely dehiscent via longitudinal slits, without terminal appendages, of varying orientation; pollen grains triporate. Hypogynous glands absent. Ovary shortly stipitate (merely narrowed towards the base), with ascending hairs; style terete, the tip not modified as a pollen presenter; stigma bilobed; ovule 1, orthotropous, pendulous, longitudinally ribbed. Fruit a drupe, globose to ellipsoidal to pyriform, with a circular depression surrounding the point of attachment, slightly asymmetrical, the style remnant slightly subterminal, with several longitudinal ribs on the inside of the endocarp, corresponding to longitudinal furrows in the seed surface.

Key to the living species

1 Adult leaves obtuse to acuminate, lacking a spinose mucro; venation more prominent on the abaxial leaf surface than the adaxial; adaxial venation (when dried) with primary vein usually prominently raised, secondary veins obscure to prominently raised, tertiary veins sometimes obscurely evident, quarternary veins obscure; primary and rarely proximal parts of secondary veins cream- to brown-coloured. Floral bracts surrounding inflorescence slightly recurved or incurved. Widest part of perianth tube unthickened. Sterile gynoecium of male flowers absent, or present but with a spathulate, obscurely bilobed tip. Style abruptly tapered at tip, not capitate ..... **1. Eidothea zoexylocarya**

1* Adult leaves acuminate, with a prominent, needle-like, apical spine 1–4.5 mm long; venation more prominent on the adaxial leaf surface than the abaxial; adaxial venation (when dried) with primary to quarternary veins prominently raised, primary, secondary and proximal parts of tertiary veins cream-coloured. Floral bracts surrounding inflorescence strongly recurved to revolute. Widest part of perianth tube distinctly thickened. Sterile gynoecium of male flowers with a prominently bifid tip. Style tip prominently capitate ..... **2. Eidothea hardeniana**

1. Eidothea zoexylocarya *A.W. Douglas & B. Hyland*

Douglas and Hyland (1995a: 473); Douglas and Hyland (1995b: 128).

Type: Queensland: Cook: Timber Reserve 1230, Boonjee Logging Area, Mt Bartle Frere, Qld, 9 Jan 1980, *B. Gray 1611* (holo QRS (not seen); iso MEL!, BRI, CANB, DNA, HO, K, L, LSU, MO, NSW, PERTH, PRE, QRS).

Trees 20–40 m high, with one main trunk 40 to 80 cm diameter at breast height, lacking subsidiary basal shoots. Bark ash-grey, flaky with pale, irregular or round lenticels. False internodes 5.0–9.5 cm long in juvenile shoots, (0.8–)1.5–10.2 cm long in adult shoots. Scale leaves of false internodes basally persistent, c. 0.75–1.7 mm long, 1.0–1.5 mm wide, distally mostly caducous, to 3.5 mm long, 0.9 mm wide. Juvenile leaves (plants to 1.5 m high) in false whorls of 3–5, elliptical to narrow-elliptical, entire or innocuous-dentate to spinose-dentate, 6.0–12.0 cm long, 2.5–4.7 cm wide; petiole 8–13 mm long; margins entire or with up to 7 teeth, with spines to 2.5 mm long, flat to recurved; tip acuminate or spinose-acuminate with apical spine to 2.5 mm long. Adult leaves in false whorls of 4–7, mostly obovate to oblanceolate or occasionally spathulate or elliptical, (1.3–)6.8–16.0 cm long, (0.4–)1.8–6.4 cm wide; petiole (2–)8–15 mm long; margins entire, usually recurved to revolute, especially towards the base; apical spine absent. Leaf venation brochidodromous or occasionally with three primary veins in adult leaves, more prominent on the abaxial leaf surface than the adaxial when dried; primary vein prominently raised on both surfaces but more prominent on the abaxial surface, cream to brown on abaxial surface, contrasting with the colour of the rest of the abaxial lamina, distally cream to brown on adaxial surface but proximally the same colour as the rest of the adaxial lamina; secondary veins prominently to obscurely evident on the adaxial surface, more prominently raised on the abaxial surface, usually the same colour as the rest of the lamina; tertiary veins usually obscure on adaxial surface, slightly raised, the same colour as the rest of the lamina on abaxial surface; quarternary veins obscure on both surfaces. Inflorescences axillary, 6–10-flowered; peduncle 3.0–6.5 mm long. Floral bracts ovate to oblong-ovate with truncate base and acute to obtuse or rounded tip, slightly recurved or incurved, 1.4–3.5 mm long, 0.6–2.2 mm wide. Male flowers with perianth 8.7–11.0 mm long; basal tubular part of perianth 2.3–3.2 mm long, 0.5–1.0 mm wide at base, dilating to 1.8–1.9 mm wide at widest point 1.0–1.2 mm from base, usually narrowing to 1.7–1.9 mm wide at tip; free tepal tips oblong-lanceolate, abruptly tapering to an acute tip, 6.0–7.8 mm long, 1.6–1.8 mm wide; staminal filaments 5.3–5.8 mm long, 0.3 mm wide at base, 0.2 mm wide at the tip; anthers 4.0–4.5 mm long, 0.9–1.0 mm wide; sterile gynoecium absent or present and ±linear but swollen towards tip, terete, with a spathulate, obscurely bilobed tip, 4.8 mm long, 0.5 mm wide at base, 0.7 mm wide at tip, with a tuft of antrorse hairs at base. Hermaphrodite flowers with perianth 10.2–11.0 mm long; basal tubular part of perianth 3.0–3.8 mm long, 1.0–1.1 mm wide at base, dilating to 2.1–2.2 mm wide at widest point 1.2–1.3 mm from base, narrowing to 1.7–1.8 mm wide at tip; free tepal tips oblong-lanceolate, abruptly tapering to an acute tip, c. 7.2 mm long, 1.5–1.8 mm wide; staminal filaments tapered towards tip, glabrous or with scattered antrorse marginal hairs in the basal half, 5.2–5.8 mm long, 0.3–0.5 mm wide at base, 0.2 mm wide at the tip; anthers not measured; gynoecium 9.2–9.3 mm long; ovary 2.3–2.5 mm long, 1.1–1.3 mm wide, with 4 dense tufts of ascending hairs in alternitepalous positions; style terete, 6.7–7.0 mm long, 0.8–1.0 mm wide, with an abruptly tapered, bilobed stigma. Fruits globose or ovoid, 3.5–6.0 cm long, 3.0–6.5 cm diameter (Douglas & Hyland 1995b).

Distribution: headwaters of the Mulgrave, Russell and Bloomfield Rivers, north-eastern Queensland.

Habitat: complex mesophyll vine forest to simple notophyll vine forest on metamorphics or granite, at altitudes from 600–1460 metres.

Phenology: flowering from January to March; fruits take about one year to develop.

Conservation status: 'vulnerable if not endangered' according to Douglas and Hyland (1995b: 128) but B. Hyland (pers. comm.) argues that since populations discovered after 1995 have greatly increased the number of known plants, this species should no longer be considered to be endangered. It is known from several conservation reserves.

Selected specimens (from 10 examined): Queensland: Cook: Mt Bartle Frere, NW peak, State Forest Reserve 755, *B. Gray 3952*, 4 Mar 1985 (MEL, NSW); Mt Bartle Frere, S slope, above boulder field, *A.W. Douglas 666 & B. Gray*, 22 May 1996 (MEL); SW slope of Mt Bartle Frere, *B.G. Briggs 7416*, 1 Sep 1983 (BRI, NSW); State Forest Reserve 755, Boonjee Logging Area, Mt Bartle Frere, *B. Hyland 12475*, 24 Jan 1983 (MEL, NSW); Wooroonooran National Park, track to Combo Creek, *P.I. Forster 23986, R. Jensen, & R. Booth*, 27 Nov 1998 (BRI, MEL).

2. Eidothea hardeniana *P.H. Weston & Kooyman*, **sp. nov.**

Arbores andromonoeciae. Folia adulta acuminata, spina apicali prominenti aciculari 1–4.5 mm longa; venatio prominentior supra, in sicco venis adaxialibus primariis usque ad quaternariis prominentibus; venae primariae ad secundariae et partes proximales venarum tertiariorum cremicolores. Bracteae florales valde recurvae vel revolutae. Pars latissima perianthii manifeste incrassata. Gynoecium sterile florum marium apice perspicue bifido. Apex styli manifeste capitatus.

Type: New South Wales: North Coast: Nightcap Range, *P.H. Weston 2469, R. Johnstone, R. Kooyman & J. Hunter*, 26 Oct 2000 (holo NSW 446591; iso AD, BRI, CANB, HO, K, MEL, MO, NE, NSW 445873, QRS).

Trees 15–40 m high, with one main trunk to 70 cm diameter at breast height, but often with up to 40 smaller subsidiary shoots with stems 0.5–10 cm diameter, branching from the base. Bark on stems >30cm diameter ash grey, with pale irregular horizontally flattened lenticels giving the impression of horizontal crinkling. False internodes 4.5–16 cm long in juvenile shoots, 8–77 cm long in basal subsidiary shoots, 2–13 cm long in adult shoots. Scale leaves of false internodes basally persistent, c. 0.7–1.0 mm long, 0.7–1.0 mm wide, distally mostly caducous, to 2.5 mm long, 1 mm wide. Juvenile leaves (plants 1–1.5 m high) in false whorls of 3–6, narrowly elliptical to oblanceolate or lanceolate, with spinose-dentate margins, 8–15 cm long, 2–5 cm wide; petiole 4–8 mm long; margins flat to slightly recurved, with 9–20 teeth, each bearing a spine 1–4 mm long; apical spine 1–4 mm long. Leaves of basal subsidiary shoots in false whorls of 2–17, elliptical to obovate or narrowly so, with spinose-dentate margins in basal false whorls, becoming entire in more distal false whorls, 9–18 cm long, 2.3–5.4 cm wide; petiole 4–11 mm long; margins flat to slightly recurved, with up to 20 teeth, each bearing a spine 1.5–4 mm long; apical spine 1–6 mm long. Adult leaves in false whorls of 4–7, narrowly elliptical to oblanceolate, with entire, flat to slightly recurved margins, (2.5–)8–13.5 cm long, (0.7–)1.7–4.2 cm wide; petiole (3–)5–10 mm long; apical spine 1–4.5 mm long. Leaf venation brochidodromous, more prominent on the adaxial leaf surface than the abaxial when dried; primary vein prominently raised on both surfaces but more prominent on the abaxial surface, cream; secondary veins prominently raised on both surfaces but more prominent on the adaxial surface, cream; tertiary veins prominently raised, proximally cream, distally green on adaxial surface, slightly raised, green on abaxial surface; quarternary veins slightly raised, green on adaxial surface, slightly raised or obscure, green on abaxial surface. Inflorescences axillary or ramiflorous, 7–11-flowered; peduncle 6–7 mm long. Floral bracts spathulate to

Fig. 1. *Eidothea hardeniana* P.H. Weston & R.M. Kooyman. **a,** terminal part of basal subsidiary shoot; **b,** juvenile leaf. a from *Weston 2464 et al.*, b from *Weston 2471 et al.* Scale bar: a = 6 cm; b = 1.5 cm.

Fig. 2. *Eidothea hardeniana* P.H. Weston & R.M. Kooyman. **a,** flowering shoot; **b,** adult leaf. From *Weston 2469 et al.* Scale bar: a, b = 2 cm.

oblanceolate with truncate base and obtuse to rounded tip, strongly recurved to revolute, 5.1–5.5 mm long 2.4–3.0 mm wide. Male flowers with perianth 8.0–9.6 mm long; basal tubular part of perianth 2.2–3.3 mm long, 0.9–1.0 mm wide at base, dilating to a thickened ring 1.3–2.0 mm from base, 2.6–3.0 mm wide at widest point, narrowing to 1.6–2.2 mm wide at tip; free tepal tips oblong-lanceolate, abruptly tapering to an acute tip, 5.0–6.3 mm long, 1.6–1.9 mm wide; staminal filaments tapered from base to tip, glabrous or with scattered antrorse marginal hairs in the basal half, 3.7–6.5 mm long, 0.35–0.5 mm wide at base, 0.25–0.3 mm wide at the tip; anthers 4.0–5.0 mm long,1.1–1.4 mm wide; sterile gynoecium linear, terete, with a prominently bifid tip, 4.7 mm long, 0.2 mm wide, with scattered antrorse hairs at base. Hermaphrodite flowers with perianth 10.0–12.0 mm long; basal tubular part of perianth 3.4 mm long, 1.2–1.7 mm wide at base, dilating to a thickened ring 2.6 mm from base, 3.8–3.9 mm wide at widest point, narrowing to 2.3–2.7 mm wide at tip; free tepal tips oblong-lanceolate, abruptly tapering to an acute tip, 6.6–7.2 mm long, 1.7–1.8 mm wide; staminal filaments tapered from base to tip, glabrous or with scattered antrorse marginal hairs in the basal half, 4.2–8.0 mm long, 0.5 mm wide at base, 0.3 mm wide at the tip; anthers 4.9–5.0 mm long, 1.2 mm wide; gynoecium 9.5–10.6 mm long; ovary 2.3–2.7 mm long, 1.4–2.2 mm wide, densely covered in ascending hairs; style terete, 7.2–7.9 mm long, 0.8 mm wide, with a prominently capitate, bilobed stigma. Fruits broad-ovoid to broad-ellipsoidal, 3.5–4.0 cm long, 3.0–3.7 cm diameter, green maturing to dull golden yellow; epidermis c. 0.08 mm thick; mesocarp 2–4 mm thick, composed of soft, pithy, cream-coloured tissue, separating readily from the endocarp; pyrene broad-ovoid to broad-ellipsoidal, with a rounded base and sharply pointed tip, 2.7–3.4 cm long, 2.3–3.1 cm wide; endocarp bony, brown, with a slightly rough surface, 2.5–4 mm thick; internal longitudinal ribs to 3 mm high, 2 mm wide. (Figs 1–4).

Distribution: restricted to a single catchment on the southern side of the Nightcap Range in north-eastern New South Wales.

Habitat: upland cool and riparian simple notophyll vine forest (to notophyll vine forest) on acid volcanics (rhyolite lithology). Dominant tree species include *Ceratopetalum apetalum*, *Endiandra introrsa*, *Canarium australasicum*, *Schizomeria ovata*, *Austrobuxus swainii*, *Cinnamomum oliverii*, sometimes with occasional emergents including *Lophostemon confertus*, *Callitris macleayana*, or *Tristaniopsis collina*.

Phenology: flowering from mid-October to mid-November; fruits take over one year to develop, reaching full size in about mid December, then changing colour from green to dull yellow over the following two to three months, falling from mid-February to early March.

Conservation status: listed as '*Eidothea* sp. 'Nightcap Range' (P.H. Weston 2469)' in New South Wales as an endangered species on Schedule 1 of the *Threatened Species Conservation Act*, 1995. This species is known to occur in Nightcap National Park and in the adjacent Whian Whian State Forest. Ninety-two trees with diameter at breast height greater than 10 cm, and 76 seedling plants, were discovered in surveys conducted by RMK to May 2001.

Derivation of name: named in honour of our friend and colleague Gwen J. Harden, whose career has been devoted to improving our knowledge of the flora of New South Wales, particularly of the State's rainforest plants.

Specimens examined: New South Wales: North Coast: Nightcap Range, *P.H. Weston 2464, 2466–2469, 2471, R. Johnstone, R.M. Kooyman & J. Hunter*, 26 Oct 2000 (NSW); Nightcap Range, *R.M. Kooyman s.n.*, 25 Aug 2000 (NSW) 444188; Nightcap Range, *R.M. Kooyman s.n.*, Nov 2000 (NSW) Nightcap Range, *R.M. Kooyman s.n.*, Dec 2000 (NSW 478642); Nightcap Range, *P.H. Weston 2550, R.M. Kooyman & P. Bernhardt*, 5 Nov 2001 (NSW, NE); Whian Whian State Forest, *L.J. Webb & J.G. Tracey*, 1953 (BRI 37567); Locality unknown, *H.C. Hayes*, date unknown (BRI 226481).

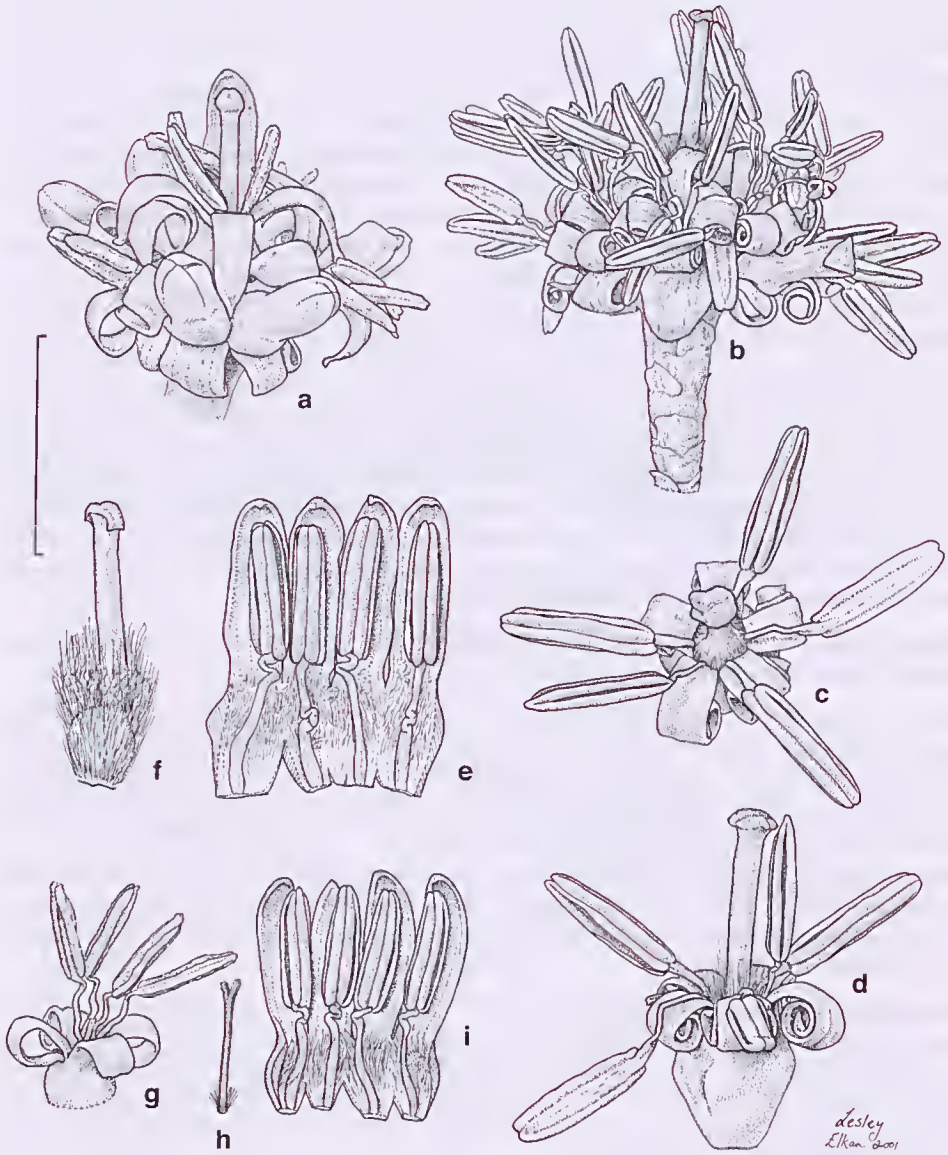

Fig. 3. *Eidothea hardeniana* P.H. Weston & R.M. Kooyman. **a,** inflorescence with flower buds starting to open, showing the central hermaphrodite flower surrounded by a false whorl of bracteate male flowers; **b,** inflorescence of open flowers; **c,** 5-merous hermaphrodite flower, viewed from above; **d,** 5-merous hermaphrodite flower, viewed from the side; **e,** 4-merous hermaphrodite flower, opened, showing perianth and stamens; **f,** gynoecium of hermaphrodite flower; **g,** male flower, viewed from the side; **h,** sterile gynoecium of male flower; **i,** male flower, opened, showing perianth and stamens. From *Weston 2469 et al.* Scale bar: a, b, g = 10 mm; c–f, h, i = 7.5 mm.

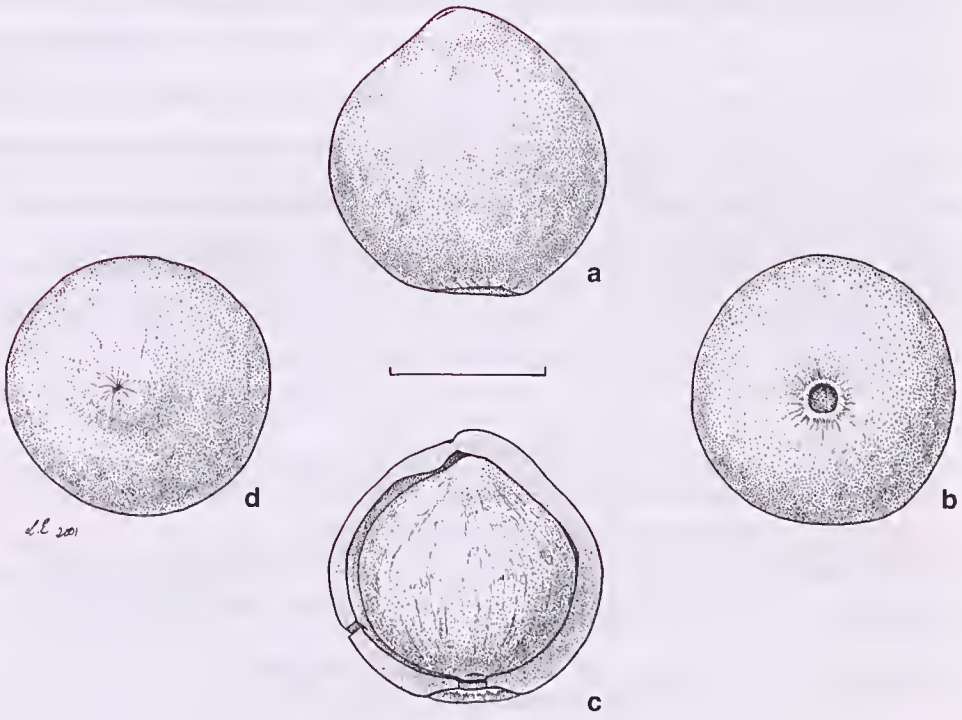

Fig. 4. *Eidothea hardeniana* P.H. Weston & R.M. Kooyman. **a,** Whole fruit viewed from the side; **b,** whole fruit viewed from below; **c,** fruit with exocarp half removed by a medial, longitudinal cut, showing endocarp, viewed from the side; **d,** whole fruit viewed from above. From *Kooyman s.n.* (NSW478642). Scale bar: a–d = 2 cm.

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SHORT COMMUNICATION

Chromosome numbers of some native and naturalised plant species in Australia

Barbara G. Briggs

Chromosome numbers are reported for 36 taxa in Centrolepidaceae, Cyperaceae, Juncaceae, Ranunculaceae and a range of other Angiosperm families. Most are somatic numbers determined on root-tip material, using c. 130 minutes pre-fixation treatment with saturated aqueous *p*-dichlorobenzene and staining by alcoholic carmine (Snow 1963). All except one count were made on Australian material; the exception is a report for *Juncus falcatus* from North America (this species has an unusual distribution, being native in south-eastern Australia, North America and north Asia). Species not native to Australia are marked with an asterisk in the following list.

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FAMILY Species	Chromosome number	Voucher (Herb. NSW)	Collector	Locality
ANTHERICACEAE				
Borya sphaerocephala R.Br.	2*n* = 28	75460	*J.T. Waterhouse*	S of Beverley, W.A
Laxmannia brachyphylla F. Muell.	2*n* = 8	89415	*K. Mair*	Kalgan Plains, W.A.
L. gracilis R. Br.	2*n* = 24	89417	*B.G. Briggs*	Wisemans Ferry, N.S.W.
APIACEAE				
Xanthosia pilosa Rudge	*n* = 10	59885	*B.G. Briggs*	North Head, Port Jackson, N.S.W.
Xanthosia pilosa	*n* = 10	55310	*B.G. Briggs*	Galston Gorge, N.S.W.
ARACEAE				
Pothos longipes Schott	2*n* = 26	98649	*A. Floyd*	Coffs Harbour, N.S.W.
BRASSICACEAE				
**Cardamine hirsuta* L.	2*n* = 16	90666,90667, 90668	*L.A.S. Johnson & B.G. Briggs*	Royal Botanic Gardens Sydney, N.S.W.
**Rorippa microphylla* (Boenn. ex Reichb.) Hylander	2*n* = 32	56839	*B.G. Briggs*	Captains Flat, N.S.W.

FAMILY Species	Chromosome number	Voucher (Herb. NSW)	Collector	Locality
CENTROLEPIDACEAE *Aphelia drummondii* Benth.	2*n* = 16	85145	*B.G. Briggs* 798	SE of Ambergate, W.A.
Centrolepis aristata (R. Br.) Roem & Schult.	2*n* = 16	85154	*B.G. Briggs* 765	4 km S of Busselton, W.A.
Centrolepis aristata	2*n* = 16	85161	*B.G. Briggs* 820	5 km W of Cookernup, W.A.
Centrolepis strigosa (R. Br.) Roem. & Schult. var. strigosa	*n* = 10, 2*n* = 20	90659	*B.G. Briggs*	Tabbigai, Kurnell Peninsula, N.S.W.
Centrolepis strigosa var. *strigosa*	*n* = 5, 2*n* = 10	84964	*A. C. Beauglehole* 1996	Gorae West, Vic.
CYPERACEAE *Carex hypandra* F. Muell. ex Benth.	2*n* = c. 90	64400	*E.D. Briggs*	Lake Cootapatamba, Kosciuszko, N.S.W.
Caustis flexuosa R.Br.	2*n* = c. 106	69624	*B.G. Briggs*	Glenbrook, N.S.W.
Carpha nivicola F. Muell.	2*n* = 42	64403	*E.D. Briggs*	near Charlottes Pass, Kosciuszko, N.S.W.
Fimbristylis ferruginea (L.) Vahl.	2*n* = 20	64422	*L.A.S. Johnson*	Vales Point, Lake Macquarie, N.S.W.
Isolepis prolifera (Rottb.) R. Br.	2*n* = c. 66	64401	*L.A.S. Johnson*	Georges R. near Casula, N.S.W.
Schoenus brevifolius R. Br.	2*n* = c. 130	64392	*E.F. Constable* 4729	junction Princes Highway and Appin Rd., N.S.W.
Schoenus imberbis R. Br.	2*n* = c. 98	69606	*B.G. Briggs*	Glenbrook, N.S.W.
Schoenus paludosus (R. Br.) Poir.	2*n* = c. 120	62244	*L.A.S. Johnson*	Lemon Tree Passage, Port Stephens, N.S.W.
Scirpus mucronatus L.	2*n* = 40	64398	*N.J. Williams*	Mooneba, W of Kempsey, N.S.W.
IRIDACEAE *Libertia pulchella* (R. Br.) Spreng.	2*n* = 36	72718	*L.A.S. Johnson*	King William Range, Tas.
Libertia pulchella	2*n* = 36	90681	*E.F. Constable*	Govetts Leap, Blackheath, N.S.W.
JUNCACEAE **Juncus cognatus* Kunth	2*n* = 60	60734	*L.A.S. Johnson*	Northbridge, N.S.W.
J. falcatus E. Mey.	2*n* = 80	72287	*B.G. Briggs*	Newport, Oregon, USA
J. holoschoenus R. Br.	2*n* = 80	34370	*R.A. Williamson*	near Barham, N.S.W.
J. pauciflorus R. Br.	2*n* = 40	90683	*E.F. Constable*	Rodriguez Pass, Blackheath, N.S.W.
Luzula densiflora (H. Nordensk.) Edgar[1].	2*n* = 12, 14	77826, 77825	*L.A.S. Johnson*	Georges Plains, S of Bathurst, N.S.W.
LOMANDRACEAE *Chamaexeros serra* (Endl.) Benth.	2*n* = 32	75459	*J.T. Waterhouse*	Porongorup to Stirling Range, W.A.
RANUNCULACEAE **Batrachium tricophyllum* (Chaix) Bosch	2*n* = 32	59304	*B.G. Briggs*	Jacobs River SW of Jindabyne, N.S.W.

FAMILY Species	Chromosome number	Voucher (Herb. NSW)	Collector	Locality
R. amphitrichus Colenso	2*n* = 72	72740	*B.G. Briggs*	44.5 km N of Benambra, Vic.
R. collinus R. Br. ex DC.[2]	2*n* = c. 48	57462	*B.G. Briggs*	Mt Coricudgy, N.S.W.
R. inundatus R. Br. ex DC.	2*n* = 48	65794	*B.G. Briggs*	8 km S of Bulahdelah, N.S.W.
R. inundatus	2*n* = 48	90689	*B.G. Briggs*	Big Boree Creek, S of Laguna, N.S.W.
R. inundatus	2*n* = 48	59884	*R. Melville & B.G. Briggs*	Hawkesbury River SE of Wisemans Ferry, N.S.W.
R. inundatus	2*n* = 48	90676	*B.G. Briggs*	7 km N of Calga, N.S.W.
R. meristus B.G. Briggs & Makinson	2*n* = 48	65788	*B.G. Briggs*	Reddistone Creek, NW of Glen Innes, N.S.W.
R. meristus[3]	2*n* = 48	53964	*L.A.S. Johnson*	Coolaburragundy River, S of Pandoras Pass, N.S.W.
R. pachycarpus B.G. Briggs[4]	2*n* = 16	57047	*W.E. Giles*	between Manildra and Gumble, N.S.W.
R. papulentus Melville	2*n* = 96	64395	*B.G. Briggs*	Crackenback River, N.S.W.
**R. repens* L.	2*n* = 32	72733	*L.A.S. Johnson*	Ocean Beach, Strahan, Tas.
**R. sceleratus* L.	2*n* = 32	89423	(not recorded)	Mullumbimby, N.S.W.
UVULARIACEAE *Schellhammera undulata* R. Br.	2*n* = 36	78665	*B.G. Briggs*	N of Calga, N.S.W.

[1] Plants in a population sample of *Luzula densiflora* showed one plant (NSW 77826) with 2*n* = 12 and three plants (NSW 77825) with 2*n* = 14. NSW 77825 was determined by L.A.S. Johnson as belonging to a form of *L. densiflora* referred to by Edgar and Wilson (1993), which has 'less hairy leaf margins, ... slightly narrower leaves and a relatively larger caruncle'.

[2] The sample is from the 'more robust and pilose' form of *Ranunculus collinus* from the Central Tablelands of New South Wales. Briggs and Makinson (1990, 2001) expressed some doubt as to whether this form is correctly placed in *R. collinus*.

[3] This sample is among examples from the Central Western Slopes of New South Wales with broad, little-dissected leaf segments, described by Briggs & Makinson (2002) as an extreme variant of *R. meristus* or possibly a separate taxon.

[4] Briggs (1962) reported the gross chromosome morphology of members of the *R. lappaceus* group; *R. pachycarpus* showed the same karyotype as other species of this group, with chromosome pairs I and II clearly distinguishable.

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SHORT COMMUNICATION

Corrections to and a new combination in *Lachnagrostis* (Gramineae)

S.W.L. Jacobs

There are some errors in my treatment of *Lachnagrostis* (Jacobs 2001) that need correcting.

(i) The combination *Lachnagrostis rudis* (Roem. & Schult.) Trinius (128: 1820) should be replaced by the earlier *Lachnagrostis scabra* (Beauvois) Nees ex Steudel. Beauvois (1812) created a new combination, *Vilfa scabra* Beauvois. *Vilfa scabra* is treated as a nom. nov. although it was based on the illegitimate *Agrostis scabra* R. Br. It is this epithet that should be used and a valid combination is available.

Lachnagrostis scabra (Beauvois) Nees ex Steudel (250: 1840)

Basionym: *Vilfa scabra* Beauvois (16: 1812).

Type: based on the type of *Agrostis scabra* R. Br. non Willd., without locality, *R. Brown* (BM).

Synonyms: *Agrostis scabra* R. Br. non Willd.; *Deyeuxia scabra* (Beauvois) Kunth (1829).

Agrostis rudis Roem. & Schult. (1817); *Calamagrostis rudis* (Roem. & Schult.) Steudel (1854); *Lachnagrostis rudis* (Roem. & Schult.) Trin. (1820).

(ii) Brown and Walsh (2000) raised Hooker's *Agrostis billardierei* var. *setifolia* to species rank. I made a new combination for this taxon in *Lachnagrostis* (Jacobs 2001) but omitted the basionym. The new combination is made here in full.

Lachnagrostis punicea *(A.J. Brown & N.G. Walsh) S.W.L. Jacobs* **comb. nov.**

Type: Tasmania: New Norfolk, 15 Nov 1840, *Ballantine 1446* (K).

Based on: *Agrostis billardieri* var. *setifolia* Hooker (115: 1858); *Agrostis punicea* A.J. Brown & N.G. Walsh (83–86: 2000).

Agrostis aemula var. *setifolia* (Hook. f.) Vickery (1941).

(iii) For *Lachnagrostis billardierei* [as 'billardieri'] (Jacobs 2001) the spelling of the epithet should be corrected to 'billardierei', and the date of the Robert Brown reference corrected to 1810.

(iv) The spelling of the specific epithet for *Lachnagrostis lacunis* should be corrected to '*lacunarum*'.

Acknowlegments

Thanks to David Mabberley and Bryan Simon who kindly pointed out the problems with my treatment of *Lachnagrostis* (Jacobs 2001), and to Karen Wilson for comments on this note.

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Corrigenda — Telopea 9(2)

K.D. Hill, L.A.S. Johnson & D.F. Blaxell. Systematic studies in the eucalypts. 11 — New taxa and combinations in *Eucalyptus* Section *Dumaria* (Myrtaceae)

Page 281: end of description should read (Fig. 10d, e, f).

Page 283: figure caption should read **Fig. 10.** *E. trachybasis*. **d,** adult leaf, inflorescence and buds. **e,** inflorescence and buds. **f,** inflorescence and fruits (from *NSW 333848*). Scale bar = 1 cm. *E. planipes*. **a,** adult leaf, inflorescence and buds, **b,** inflorescence and buds. **c,** inflorescence and fruits (from *J. Baker 128*). Scale bar = 1 cm.

Page 284: end of first paragraph should read (Figs 10a, b, c).

Page 313: figure caption should read **Fig. 28.** *E. rediniculifera*. **a,** adult leaf, inflorescence and fruits, **b,** inflorescence and buds, **c,** inflorescence and fruits (from *Gardner 11153*). *E. polita*. **d,** adult leaf, inflorescence and fruits, **e,** inflorescence and buds, **f,** inflorescence and fruits (from *Johnson 9099B*). *E. paralimnetica*. **g,** adult leaves, inflorescence and buds, **h,** inflorescence and buds, **i,** inflorescence and fruits (from *Crisp 5954*). *E. kondininensis*. **j,** adult leaf, inflorescence and fruits, **k,** inflorescence and buds, **l,** inflorescence and fruits (from *Gardner 1843*). Scale bar: a, d, g, j = 3 cm, b, c, e, f, h, i, k, l = 1 cm.

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Deadlines for the submission of papers are 1 June (for the first issue the following year) and 1 November (for the second issue).

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